THURSDAY, SEPTEMBER 5, 1878

THE ZOOLOGICAL RECORD

The Zoological Record for 1876; being Volume Thirteenth of the Record of Zoological Literature. Edited by Edward Caldwell Rye, F.Z.S., &c. (London: 1878.)

ANOTHER volume of this useful annual is now before us. When, about a twelvemonth since, we noticed (NATURE, vol. xvi. p. 357) its predecessor, we took occasion to complain of the ingratitude of zoologists in not giving more efficient support to a work which, if not indispensable to the due prosecution of their studies, would at least lighten their labours in a remarkable degree, and we pointed out how it was a matter of obligation upon all literary and scientific institutions to include the *Zoological Record* among the books they regularly purchase. We fear that our words fell upon dull ears, and that there is as much need now as there was then to impress these considerations on the public. The Zoological Record Association, to judge from its recent balance-sheet, still lives upon charity, to the great discredit of the zoologists of our own tongue as a body, and if its existence be prematurely brought to a close, it will be to their everlasting disgrace. In some respects the energy of zoologists is boundless, in other respects their apathy is amazing. They will compass sea and land to gain one new specimen for their collections, or one apparently new species for their monographs. They think themselves happy in the short-lived glory of being able to inscribe "*Nobis*" or "*In Mus. nostr.*" after its name in some printed list; but they care very little to know what others are doing in the same line of research, and when a few years after, some industrious German or Scandinavian naturalist quietly relegates the name on which they had plumed themselves to the limbo of synonyms (perhaps with a mark of admiration which does not mean praise), they accept the rebuff and console themselves with the reflection that "a fellow can't be expected to know everything," or, if twitted by a friend, will ask in an aggrieved tone whether it is possible for anybody to be acquainted with the contents of two hundred foreign journals. Then, again, there is the obstacle caused by dislike to, or suspicion of, any new thing, from which even scientific men are not entirely exempt. The conchological investigations of Mr. A. or the entomological studies of Dr. B., some thirty or forty years ago, conferred imperishable renown upon the ancient borough of Little Pedlington, in which they were both resident. Their investigations and their studies were accomplished without the aid of the *Zoological Record*. Therefore the *Zoological Record* is of no use to persons engaged in such labours, and therefore the Little Pedlington Literary and Scientific Institute need not go to the expense of adding the yearly volumes of the *Zoological Record* to its bookshelves. Perhaps some of our readers may smile, but we believe this to be no uncommon case, and though the sight of a just man struggling with adversity is said to have been pleasant to the gods of old times, we cannot say that the condition of the Zoological Record Association awakens similar feelings in ourselves.

Now as to the present volume. With the same contributors as the last, it has naturally almost the same qualities; but the editor has introduced a new feature in the separate pagination of many of the records. This scheme has been tried, he tells us, in the hope of saving time, but the very insignificant amount of delay which it seems to have avoided, appears to us but a poor and utterly inadequate recompense for the additional trouble there always is in citing a book so paged, and the amount of confusion to which this manifold system invariably gives rise. Here we have page 1 fifteen times over, and yet one set of numbers runs to 240 pages! We certainly trust the editor will reconsider his determination of continuing this practice, though he holds out hope of its "possibly leading to other improvements." Otherwise we have not a word to say against Mr. Rye's management, which, as before, proclaims his great ability. We venture, however, to throw out a suggestion that perhaps may not be included among his possible improvements. This is that *general* works should receive a separate notice in addition to that which each individual recorder thinks fit to give them. The year 1876 will long be remarkable as that in which Mr. Wallace's great work on the "Geographical Distribution of Animals," appeared; but we must say that the attention it receives in this volume of the *Zoological Record* is utterly unworthy of the magnitude of the subject. Our readers shall judge for themselves. The recorder for *Mammalia*, Mr. Alston, after most properly naming it especially in his preliminary remarks, says of it:—

"A considerable part of this most important work is devoted to the Mammalia. Besides the discussion of the genera characteristic of each of the zoological regions and sub-regions, the classification of Mammals is considered (i. pp. 85-90), the distribution of the extinct forms (i. pp. 107-160), and that of existing families and genera (ii. pp. 170-254). The author believes that the principal groups first appeared in the northern hemisphere, from which the southern continents were peopled by successive waves of migration."

The recorder for *Aves*, Mr. Salvin, writes:—

"The class Aves supplies a large proportion of the material investigated in this work, and the distribution of birds entering into the subjects is examined under the the following heads:—(Part i.) The principles and general phenomena of animals. (Part ii.) On the distribution of extinct animals. (Part iii.) Zoological Geography: a review of the chief forms of life in the several regions and sub-regions, with the indications they afford of geographical mutations. (Part iv.) Geographical Zoology. a systematic sketch of the chief families of land animals in their geographical relations. The book itself is full of details most carefully elaborated, and is doubtless destined to be the standard work on the subject for some time to come."

The recorder for *Reptilia*, Mr. O'Shaughnessy, descants at greater length:—

"The geographical distribution of the families and genera of Reptiles and Amphibians is treated collectively as a section, in chap. xix. of this work, vol. ii. pp. 392-423.

"In discussing the means of Dispersal and Migration of the various classes of animals, Mr. Wallace remarks (vol. i. p. 29) that Reptiles, exclusive of serpents and sea-snakes, being scarcely more fitted than Mammals for traversing seas and oceans, are generally wanting in

oceanic islands which possess no indigenous Mammals; this rule is, however, subject to exceptions among the lizards, which apparently have some unknown way of passing over the ocean (probably in the egg state), as they are found to inhabit many islands where there are neither Mammals nor snakes. Snakes entirely cease at 60° N. lat., and at 6,000 feet elevation in the Alps. Lizards, though essentially tropical, go sometimes farther north than snakes, and ascend higher, reaching 10,000 feet in the Alps. Amphibians extend much farther north; Frogs to within the Arctic circle; their eggs are no doubt carried certain distances by aquatic birds, but salt water is fatal to them, and deserts and oceans constitute the most effectual barriers to their dispersal.

"Further remarks on the possible mode of transport of Reptiles to remote distances are made, vol. i. pp. 400-401, where the author treats of the points of similarity between the fauna of the Australian region and that of South America.

"Describing first in detail the faunæ of the six great geographical regions (Neotropical, Nearctic, Palæarctic, Ethiopian, Oriental, and Australian), the author refers successively to the Reptiles in their subordinate relation to each fauna, and afterwards, vol. ii. pp. 372-423, collects his results and tabulates them under the heads of the different families."

None of the other recorders seem to make mention of the work, except Dr. von Martens, who, under the head of *Mollusca*, contents himself with the following:—

"A. R. WALLACE gives an outline of the geographical distribution of the terrestrial (and freshwater) Mollusca in his 'Geographical Distribution of Animals,' vol. ii. pp. 512-529 and 534-535, and some instances of means for their passive dispersal, vol. i. p. 31."

Now we humbly submit that no adequate idea of Mr. Wallace's work is given by any one of these notices separately nor by all of them combined. As we said on the last occasion, we cannot find it in us to criticise the recorders, though they differ greatly (and this will be evident from the above extracts) in their mode of treatment. But in a case like this the editorial hand might surely be shown with advantage, and none can doubt that in a few sentences Mr. Rye, had his scheme allowed it, would have been able to put the reader in possession of Mr. Wallace's general principles and general results, while the different recorders would still be left to show how those principles and those results affect their respective branches.

It is, perhaps premature to say that the excellent plan of giving an index to the genera and sub-genera recorded as new, and of marking those names that had been bestowed before, has yet had the wholesome disciplinary effect that was expected of it, but there are indications that such is the case. The index to last year's volume showed that *fifty-nine* preoccupied names, implicating *thirty-seven* authors, had been reintroduced to zoological literature in the year 1875. The present volume shows the corresponding numbers to be *thirty-six* and *twenty-eight*—a manifest improvement, though not quite so great as at first sight appears, since in 1875 nearly a *thousand* new genera or sub-genera were instituted, while in 1876 the number is only about *eight hundred and seventy*. No one has again sinned as M. Mulsant did on the last occasion, but it seems strange that so learned an entomologist as Dr. Leconte should now head the list of offenders with *four* homonyms, and we suspect this must be due to a different reading of the laws of nomenclature which may obtain in America. Next to him come Messrs. Cope, Dybowski, Jacovleff,[1] Kirchenpauer, Linstow and Snellen with *two* each, and the rest with one. The selection of the same name, *Coptingis*, for two apparently distinct genera of *Erotylidæ* by M. Chapuis and the late Mr. G. R. Crotch, is curious, and the Arachnid *Corynethrix* of Dr. Koch, and the Thysanurous *Corynothrix* of Herr Tullberg seem to clash with one another. Collisions of this kind are, of course, unavoidable, but of the three dozen homonyms which come into the crop of 1876, a score-and-a-half might certainly have been avoided had their authors but followed the advice of Mr. Rye's motto:—

"Explorate solum: sic fit via certior ultra."

That is to say had they consulted their Agassiz's *Nomenclator* and used the *Zoological Record*.

It remains for us to say that the present volume contains an abstract of the zoological portion of more than two hundred-and-fifty distinct periodicals, besides separately published works, and that those journals hold a good deal hardly any one requires to be told. Nevertheless, it may be new to some of our readers to learn that papers which have appeared in the older volumes of many of these periodicals are in so much request that lists of them, with the proper pagination, are being reprinted. This has been done in the *Deutsche entomologische Zeitschrift*, by Herren von Heyden and F. Blücher, with regard to the entomological articles in the first sixteen volumes of *Der zoologische Garten*, the first thirteen of the *Verhandlungen des naturforschenden Vereines in Brünn*, four volumes of the *Bulletin de la Société des Naturalistes de Moscou*, and fourteen of the *Archiv für Naturgeschichte*. Trusting that next year we may be able to congratulate Mr. Rye and his fellow-labourers on having a more promising prospect before them, we bid them be of good cheer, for they have the sympathies of all who know how to appreciate hard and honest work.

OUR BOOK SHELF

Annual Report and Transactions of the Plymouth Institution and Devon and Cornwall Natural History Society. Vol. VI. Part II. 1877-78. (Plymouth: Bredon and Son.)

THIS Report seems to us to deserve more than the passing notice we gave it in a recent note on the Reports of provincial societies. The society embraces a wide range of work—science, history, archæology—and many of the papers which it publishes will compare favourably with papers of a similar class read in metropolitan societies. The society has a large membership, and valuable collections in various departments. In the Report before us the president, Prof. Anthony, discusses various interesting points in connection with the doctrine of evolution, and although he holds the theory to be "not proven," his discussion of the subject is fair. Mr. R. N. Worth, a great authority on most subjects connected with Plymouth, has papers on "The Palæontology of Plymouth," "The Early Commerce of Plymouth," a paper of much interest showing considerable research, and "The Ancient Heraldry of Plymouth." Mr. R. Briggs's paper on "The Hedgerows

[1] It is much to be wished that there were some recognised way of rendering Russian proper names into the languages of Western Europe. Germans, Frenchmen, and Italians, each render them phonetically, and of course the name is differently spelled according to the nation of the writer. Mr. Jacovleff's name thus appears also as Jakowleff, Yakovleff, and Jacovlev!

of Plymouth," is valuable and readable, containing the results of careful observation. "A Catalogue of the Geometrina of Plymouth and its Vicinity," by Mr. G. C. Bignell, will interest entomologists. "Our Obligation to Greek Thought," by Prof. Chapman, is a thoughtful paper, and there are several other excellent papers of historical and antiquarian interest.

Vulcanologische Studien. Von Dr. Eduard Reyer. (Wien: 1878.)

WE have already had occasion to direct attention to the valuable contributions to the theory of volcanoes which have recently been published by Dr. Reyer, of Vienna. The memoir before us fully maintains the reputation of its author as an able investigator and original thinker. In it he discusses the nature of the materials which remain in the throat and deeper portions of a volcanic vent, after the eruptive action has ceased, and the features presented by those volcanic cones which are formed not by violent explosive action but by the quiet outwelling of liquid lava. Dr. Reyer's remarks on both these questions will be found to be eminently valuable and suggestive. J. W. J.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Is the Sun One-sided?

WHEN Broun and Hornstein detected the existence of a terrestrial magnetic inequality, of which the period is nearly that of the sun's rotation, it was natural to regard this inequality as a direct result of the rotation of our luminary. Nevertheless, there are grave reasons against this hypothesis. In the first place, it is extremely difficult to imagine the sun to be one-sided in its magnetic influence. From what we know of our luminary, it must in a great measure be composed of gaseous matter, of which the outer layers are in violent motion, so that we can hardly imagine one meridian to be permanently different from another.

Another objection is derived from the fact that the period of this peculiar magnetic inequality (of whose existence there can be no doubt) is very nearly that of the sun's rotation in space, and decidedly less than that of its synodic rotation. Now, if we can imagine the sun to affect the earth in this peculiar manner, we should be inclined to suppose that the period of such influence would be that of its synodic rotation, that is to say, of its rotation with regard to the earth.

But if this inequality be not due to the sun's rotation, how (it may be asked) is it possible to account for it?

In the first place there is accumulating evidence of the existence of an intra-mercurial planet with a time of revolution, not differing greatly from that of the sun's rotation. Again, there can be little doubt that we have various magnetic inequalities, of which the periods are the same as those of the most prominent planetary configurations. May not, therefore, this magnetic inequality be connected with the intra-mercurial planet of the existence of which we are becoming sure, and is it not possible that a discussion of magnetic changes may aid us in settling this very interesting and important question?

St. Andrews, August 26 BALFOUR STEWART

Von Cotta's "Geologie der Gegenwart"

YOUR journal contains, in the number for August 8, a short notice of my newly-published "Geologie der Gegenwart," with a signal misrepresentation of the coloured frontispiece, beginning with the lines, "We can scarcely regard," to the end of the paragraph.

The illustration in question really is a representation of the fact that igneous rocks—both volcanic and plutonic—being originally products of the central parts of earth, form different species, according to their being rich in silica (acidic rocks) or poor in silica (basic rocks), and according to their consolidation at a considerable depth as *plutonic*, or nearer the surface as *volcanic* rocks. Becoming solid at a great depth, the *acidic* fluids have formed granites or porphyrites; nearer the surface, trachytes or trachytic lavas. The *basic* fluids, on the other hand, became syenites or greenstones at a great depth, and basalts or basaltic lavas nearer the surface.

All these various rocks by no means belong to particular geological periods, but *at all times* have either overflowed or penetrated other formations, and been accompanied by tuff formations.

The misapprehension contained in your notice is doubly painful to me, because I think I have been the first German geologist who decidedly adopted Lyell's view with regard to the utter independence of the nature of rocks from their geologic age: witness the first edition of my "Geologie der Gegenwart," published in 1866. BERNHARD V. COTTA

Freiberg

On the Wax of Pœciloptera

A SPECIES of Pœciloptera was this year rather common in the neighbourhood of this city, covering thickly the branches of *Cassia obtusifolia*, L., and more sparingly of *Cassia spectabilis*, D.C. I have not the means of identifying the species; I inclose, therefore, the wings of a specimen, so that some entomologist may give you the right name.[1] The females of Pœciloptera, as indeed of many other Fulgoridæ, are known to have the property of secreting a wax-like substance from between their abdominal rings, and especially from peculiar appendages of the last ring. This substance is, in the present species, of a beautiful white colour, glossy like silk, and formed of exceedingly thin threads, 1-500 to 1-700 of a millimetre thick, and generally less than a centimetre long. When taken off the living insect, the latter will be found to produce new threads in somewhat less than twenty-four hours. The threads are pure wax, lighter than water, insoluble in cold alcohol and ether, but dissolving a little in hot alcohol, and very easily in hot benzol. The fusing-point I found by repeated experiments to be *a little higher* than that of boiling water, though I could not determine it exactly, owing to the small quantity of wax I had collected (from 150 insects I obtained but six centigrammes of wax). In a heated silver spoon, or on platin-foil, the wax melted very easily, leaving no residue whatever. The molten wax was at first of a light yellow colour, which disappeared again after its getting cold.

The late Mr. D. Hanbury, in a paper on the insect-white-wax of China ("Science Papers," 62), quotes the statement of Capt. Hutton as to the properties of the wax of *Flata limbata*, an insect closely related to the Pœciloptera. It is said to "dissolve readily in water, while the attempt to melt it on the fire without water or oil proved altogether abortive, the wax merely burning and consuming away till it became converted into a hard and baked substance." This is certainly very singular, and it appears to me highly questionable whether Capt. Hutton's so-called *wax* was any wax at all.

I have not been able to find out what can be the benefit the insects derive from these copious secretions; but as they occur only in the females, there will probably be some connection with the egg-laying or hatching process. I observed no males, and could discover no eggs even in places where the females were thickly crowded on the branches. I should add that the insect is generally rather uncommon in our local fauna.

Carácas, July 15 A. ERNST

Spontaneous Combustion of Wasps' Nests

SOME time ago the house of General P. M. Arismendi (now Consul of Venezuela, in Port-of-Spain, Trinidad) in this city, had a rather narrow escape from being set on fire by the spontaneous combustion of a large wasps' nest (a species of *Polistes*) in a closet under a roof. The day was exceedingly hot; but this circumstance, I think, has a very slight connection (if any at all) with the outbreak of smoke from the nest. Roofs in this country are constructed of tiles supported by a thick layer of compact earth, which rests on the usual lath-work of dry canes (the stems of *Gynerium saccharoides*, or arborescent grass), both being substances that conduct heat very badly.

[1] An entomological correspondent informs us that the wing is that of *Pœciloptera phalænoides*, Linn., and agrees with Stoll's figure of the insect from Surinam.—ED.

The source of heat must therefore have been in the nest itself. In bees-hives the temperature rises sometimes as high as 38° C. (*teste* Newport, as cited in Girdwoyn, "Anat. et Physiol. de l'Abeille," p. 23). We may be allowed to suppose that something similar happens occasionally also in wasps' nests. Such a heat might be caused by an alteration beginning in the wax, hydrocarbons being formed, which, on being absorbed by the paper-like, porous substance of the cell-walls, must get still more heated, so that a comparatively small access of oxygen would be sufficient to set the whole nest on fire.

I have been assured that the spontaneous combustion of wasps' nests is a well-known fact in the interior of Venezuela, and as I do not recollect having found it mentioned in books, it appeared to me worth while to inquire whether something similar has been observed in other parts of the world, and if so, whether my explanation will hold good in all cases.

Carácas, July 15 A. ERNST

Observations on a "Dust-Whirl"

WHILE making magnetic determinations at Kirksville, Mo., several "dust-whirls," or small whirlwinds, were observed, which, although not destructive in their effects, were unusually violent. The dust was carried by strong surface-winds, which rushed inward to the centre of the whirl, rising in a vast column 200 feet high.

One of these whirls crossed a pond of water, moving very slowly, and in a zigzag path. The water immediately became agitated, a *depression* was formed, which extended to the bottom of the pond (which was about five feet in depth). The top of the cup-shaped depression was about six feet in diameter, the bottom about four or five feet. There was no water drawn up from the pond, so far as could be observed, although a little of the rapidly whirling water at the edge of the depression was thrown outwards upon the surface of the pond.

Kirksville is situated in the northern part of the State of Missouri, and on the summit of the divide between the Mississippi and Missouri Rivers. During the present summer it has had the least rain in the State, and is yet parched by excessive drought. FRANCIS E. NIPHER

August 5

The Telephone

ON to the centre of a telephone vibrating disc, and perpendicular to its plane, a light needle ½ inch long was soldered, the disc held in a holder, mouth-piece, &c., the same as a telephone, and so arranged that the needle would vibrate in a small cylindrical ebonite cup, ¼ inch in diameter and ¾ inch long, the top of the ebonite cup just free from touching the vibrating disc; a copper wire was let into the centre of the bottom of the cylinder, flush with the bottom; the cylinder was filled full with the finest dust of iron filings well shaken down.[1] A battery circuit was then completed with connecting wires, through the vibrating disc, iron filings, the copper wire let into the bottom of the cylinder, and through a pair of telephones in a distant room; after finding out by experiment the distance off the speaker ought to stand when speaking to this transmitter, and the proper degree of loudness he ought to give to his words, the voice came as clearly (and louder) as if a telephone had been used for a transmitter. If the speaker came too close or spoke too loudly the words were indistinct, and mixed up with a fizzing sound. In the experiment which was most successful the speaker was about 18 inches from the transmitter and spoke in an ordinary tone of voice. But this distance I found to vary with the thickness of the vibrating disc; a thin disc transmitted clearly only when the speaker was 3 feet off.

The ebonite cylinder was also filled with water (distilled) as an experiment, instead of iron filings. I thought that possibly the resistance of the circuit would be altered through the water, as the needle vibrated to and from the copper wire opposite to it; but no sounds were found to be transmitted. If the resistance of the circuit was altered when the disc vibrated in this experiment, it might tend to support the idea that alteration in the resistance of a circuit was not the only thing required to cause sound to be transmitted, but that "false contact" was necessary, such as would take place when the needle vibrated in the iron filings. G. R. R. SAVAGE

Roorkee, July 8

[1] The disc well tapped with the hand so as to loosen the filings round the needle.

The Electro-Magnet a Receiving Telephone

THE result I have arrived at whilst experimenting in this direction seems so interesting, and at the same time, I believe, novel, viz., *that a good receiving telephone can be made from electro-magnets alone without any vibrating diaphragm*, that I hope by prior publication, to prevent the possibility of a string of those patents which nowadays so greatly hamper true scientific invention.

In my earlier experiments I made an electro-magnet out of a piece of ⅜-inch iron gas pipe ¾ inch long, filed flat on one side, and split sufficiently only to allow the wire (No. 24) to be wound on, which was done till it was full inside. The poles were therefore together about ¾ inch square. This was fixed inside a small cigar box, under a ferrotype plate, covering a rectangular hole cut in the lid 2¼ inch by 1½ inch. With a Hughes' carbon-pencil-microphone tilted to an angle of 45° as a transmitter, a small musical box as a source of sound, in a distant part of the house, and one of Leclanché's cells in circuit, this box gave out tunes plainly heard by all sitting in the room.

Whilst experimenting with another similar magnet, I stood it loose, poles downwards, but still connected with the line wires on a flat tin gunpowder canister with the ends cut off, but still retaining the paper label on which the magnet lay; the tune of the musical box was given out loudly and resonant, but buzzing and jangling; also words spoken to the transmitter were heard, but confused together.

Now this was a very interesting result, which led to the next discovery; for, having a small ordinary electro-magnet with its armature in front (as used in electric bells), fixed to a piece of board, I was about to unship it to try experiments in various tin cans, &c., when it occurred to me to connect it as it was, to the line wires, placing only a slip of paper between the poles and armature to prevent actual contact. To my astonishment, on putting the ear close to the board at any part, the music of the box was heard clearly, every note from highest to lowest being distinctly given. Now here seemed to be a telephone without a vibrating diaphragm; but, to make more sure, the armature was unscrewed from its support and attached to the magnet only by an india-rubber band, with the slip of paper between it and the poles, so that it touched no other part of the apparatus. On listening to the supporting board, the sounds were heard as distinctly as before.

But even here forensic ingenuity might claim and attempt to prove that this ordinary armature was a vibrating diaphragm; therefore, an armature being itself nothing but an induced magnet, it was replaced by another electro-magnet, thus:—

Two ordinary electro-magnets (unscrewed from a couple of large electric bells) were fastened, by means of two little wooden saddles and a screw each, to a small piece of deal board about 4½ inches square and ⅝ inch thick, in such a way that the poles were all but touching. Their wires were then joined so that poles of opposite denominations faced each other, *i.e.*, north opposite south and *vice versâ*. This placed on an empty cigar-box and four Leclanché cells in circuit, gave out the tune of the musical box clearly and loudly in the room. When both poles were made to touch, the sound ceased; but with a thin piece of paper or stout tin-foil between them, without any intervening air space, the sound was heard. On gradually separating the magnets, the sounds grew fainter and fainter, till they became inaudible.

By putting the base-board close to the ear, whistling and singing to the microphone were very clearly and loudly heard, also the voice of the person speaking could be recognised; but words were hardly sufficiently defined to distinguish all that was said, though now and then parts were intelligible.

One of the electro-magnets was afterwards replaced by a small permanent steel horse-shoe magnet fastened to the board in a similar manner, the result was the same, but, I imagined, slightly louder, probably from there being less resistance.

By varying the strength of battery, size, or mode of mounting magnets, or adjustment of the microphone, I have no doubt that perfect definition can be obtained. The loudness and volume of the sound are ample; but before making further experiments, for which I have at present little time, I hasten to communicate the *fact* that *the electro-magnet, without any diaphragm whatever*, can be made a reproducer of sounds transmitted by a Hughes' microphone, and thus *a complete and practical telephone system produced without the possibility of infringing anybody's patent*.

I must add that the same arrangement is also a feeble transmitter, using a good Bell's telephone as a receiver, which is a very strange fact. I abstain at present from all theory on the subject. F. G. LLOYD

The Sea-Serpent Explained

ON Monday, August 5, a number of geologists crossed in the Folkestone boat to Boulogne, to study the interesting formations of that neighbourhood, and, when about three or four miles from the French coast, one of these gentlemen suddenly exclaimed, "Look at that extraordinary object passing across the bow of the steamer, about a mile or a mile and a-half in advance of us!" On turning in this direction there was seen an immense serpent, apparently about a furlong in length, rushing furiously along at the rate of fifteen or twenty miles an hour; it was blackish in front and paler behind; its elongated body was fairly on the surface of the water, and it progressed with an undulating or quivering motion: *mirum erat spectaculum sane.*

Of course many suppositions were immediately started to account for this extraordinary phenomenon, but they quickly changed and settled into the fixed idea that the object before them could be nothing less than the great sea-serpent himself; for,—

> "Prone on the flood, extended long and large,
> Lay floating, many a rood, in bulk as huge
> As whom the fables name of monstrous size,
> Leviathan; which, God of all his works
> Created hugest, that swim the ocean stream."

The writer fortunately had with him one of Baker's best opera-glasses, and, after a few moments' use of this little instrument, the wonder was satisfactorily resolved. The first half of the monster was dark and glittering and the remainder of fainter hue, gradually fading towards the tail. The glass did not determine the matter until the extreme end was reached, and then it was seen to consist of a mass of birds in rapid motion; those that were strong on the wing were able to keep well up with the leaders, and so make the head appear thicker and darker by their numbers, whilst those that had not such power of flight were compelled to settle into places nearer and nearer the tail. Doubtless these birds were shags (*Pelicanus cristatus*) returning to their homes for the night from the distant waters in which they had been fishing, during the day; perchance it may be wrong to assert positively as to the variety of bird, but inasmuch as the writer has often seen shags on the Cornish coast in smaller numbers returning in single or double file to their roosting places, and since it is stated in works of natural history that they have been noticed occasionally flying in this peculiar manner to the number of a thousand or more, it does not appear an unwarranted liberty in supposing that they really were *Pelicani cristati.*

It is to be feared some of the geological gentlemen still doubt the interpretation of the lorgnette, preferring the fond deceit of a large and unknown serpent; but as in this case individual birds (scores of them) were distinctly seen flapping their wings, the writer has thought it his duty to report the circumstance to you that your readers who voyage across the seas may keep their opera-glasses in their pockets and verify for themselves, on the first opportunity, this interpretation of the great sea-serpent.

JOSEPH DREW

4, Foxgrove Road, Beckenham, Kent

Parental Affection in Sparrows

I SAW a touching little incident showing the affection of sparrows for their young on the Kennington Oval cricket-ground last Thursday afternoon, a description of which you may, perhaps, think it worth while to record.

The afternoon was fine and the ground was surrounded by a dense ring of spectators, when a young pale-coloured sparrow, under the guidance of both its parents, was trying to acquire the use of its wings. A slight wind was blowing towards the spectators, and the poor little bird, in its weak attempt to fly, was, to the evident consternation of its parents, carried straight into the laps of the inner ring of spectators, one of whom caught it gently in his hand and held it.

When taken hold of the young bird gave two or three chirps or calls for help, and the old birds flew to within a few feet of the ring of spectators, and, alighting on the grass in front of them all, began to "beg" for the young bird in the most touching and beseeching manner. This they did by lowering their heads and making the peculiar flutter of the wings by which young birds beg for food from the old ones. This singularly touching appeal moved the hearts of many in the crowd, who called out—"Look! look at the old birds!"—"Don't hurt the young bird!"—"Give it back to them," &c. The anxiety and the boldness of the old birds and their humble beseeching for the young was so evident as to come home to the hearts of these somewhat rough spectators.

My own feeling certainly was that I could not have believed that a pair of sparrows could possibly have "begged" with such touching humility and tenderness for the safety of the young bird. Their manner clearly displayed their sense of their own want of power to help the object of their affection, they therefore prayed for mercy in their own way, and with so much feeling, as to excite the full sympathy of the crowd looking on, and to make them, for the time, forget the game of cricket they had come there to see.

C. R.

Bristol, August 17

PHYSICS IN PHOTOGRAPHY

IN taking a retrospective glance at the remarkable phenomena exhibited in photography, an endeavour will be made to explain them as far as possible by the light that may be thrown upon them by modern research, and at the same time to suggest extensions which probably may be given to this branch of science by further investigations. We may perhaps be open to rebuke from some for venturing to call photography a science; but surely as long as there are problems in it to be solved which require direct scientific solution, and which perhaps indirectly lead to the research in other directions, so long, at least, must it be something beyond a mere industrial pursuit. It is not the fashion to deny to electricity the honourable distinction of being a science, although it has become an industry in its application to telegraphy; why, therefore, it should be considered correct to consider the study of the chemical action of light upon compounds as something to be remitted to the intellect of those who are merely interested in it commercially, it is difficult to understand. It would surely be much better that men of science who employ photography in their laboratories and observatories, should endeavour to understand the science of attack with the weapon they are using, instead of regarding it as a simply mechanical agency, which is only worthy of the attention of, perhaps, a half-educated assistant. If our men of science who employ both were to be as ignorant of the principles of electricity as they too often are of those of photography, research would be very much restricted in its results; and it may, it is believed, be said with truth that a familiarity with even the first principles of photography would very much extend it. We may remark, by the way, that to instil a love of science into youth, an education in photography would seem to be of great value, as experiments can be made which have a real meaning to the experimenter, and which, by allowing an almost endless variation, offer an unlimited field for the exercise of the reasoning faculties. A study of photography, in short, must encourage the study of chemical and physical sciences, if a distinction may be made between the two.

Photography must undoubtedly be divided into two distinct branches: the direct production of the visible image by light itself, and the development of the invisible image by chemical means. The recognition of the former we owe to Wedgwood, and of the latter to Daguerre. The discovery of the former is much less remarkable than of the latter, since, without any particular research, a discoloration of a compound by light must have been noticed, whereas the development of an invisible image would have been a matter of theoretical reasoning, unless accident showed its feasibility. We know that the development of Daguerrean images was discovered accidentally by Daguerre, and we also know that the development of the image on paper was discovered accidentally by Reade. Without two such wonderful strokes of good fortune the growth of photography might have been retarded for years. The years which succeeded the discovery of the developable image were productive of research into many of the phenomena exhibited by the action of light on sensitive compounds, and, owing to the great intellects

who gave their attention to it, many important problems in photography were solved. Succeeding these years, however, were others in which little was done in the absolute science of the subject, though great progress was made in perfecting the processes which had been brought forward. Within the last few years a fresh start in research in all directions seems to have been made, and much that is valuable in elucidating the correct theories on which photography is based has been demonstrated, and it is to this to which attention will be drawn.

With the risk of being tedious, ground which has been well trodden must once again be briefly gone over, in order to estimate the progress which more recently has been made. Scheele, the Swedish chemist, as is well known, found that the blackening of silver chloride (which was the basis of Talbot's pictures) gave up chlorine on exposure to light, thus proving, as it were, that the blackening was due to the formation of a new chemical compound. As far as can be traced not much more was known regarding this compound; but it was a generally-received notion that it was a subchloride of silver; and up to the present time we find that such is the accepted opinion. In the second edition of Hunt's "Researches on Light," published in 1854, at p. 79, a remarkable experiment is noted. He says:—"The exposure (of silver chloride) in the water was, in another case, continued for several days, but no greater degree of darkening occurred; but a curious fact was noticed. It was found that during the night nearly all the chlorine which had been liberated during the day was recombined, and that the darkened powder became lighter" . . . . He then, after recounting other experiments, says (p. 123):—"From other experiments I am inclined to believe that the first action of the solar ray is to liberate one half of the combined chlorine, which is very readily, moisture being present, replaced by oxygen. By the continued action of the exciting cause the oxide is decomposed, and metallic silver in a fine state of division, is formed over the surface" (of the paper).

P. 125:—"The absorption of oxygen, or rather its combination, with the decomposing chloride is proved by another very easy experiment. Some pure chloride of silver was arranged in a bent tube closed at one end, and the other end immersed in a bottle of distilled water. In this state the chloride was exposed for many days to the action of sunshine, during which time it was frequently shaken for the purpose of exposing the whole of the powder and its influence. As the chloride darkened, the water rose in the tube, and it gave a precipitate of chloride of silver on the addition of the nitrate, thus appearing to prove the substitution of oxygen for chlorine under the agency of solar radiation. It was quite evident that some absorption of atmospheric air had taken place. This explanation will also serve for the iodide, bromide, and some other salts of this metal (silver)."

This last experiment has lain fallow for years, and it is only recently that it has had any meaning beyond that indicated in the quoted paragraph. It must be borne in mind, however, that the visible change in the chloride is here under consideration, and that the invisible effect of light was not mentioned.

With regard to the developable and invisible image, till within the last few years, it was a debatable point as to whether the action of light on a sensitive compound was really a chemical change, or simply a physical action; one school held that the sensitive compound was not altered in composition at all, but that in some mysterious manner the atoms of the molecules composing it were shifted, and possessed a new property which was denied to it in its original form. Diagrams were introduced to render this subtle change clear to the student, one of which is reproduced (Fig. 1).

In A we see two ovals slightly differing in size, each of which was intended to indicate one of the atoms composing a molecule of the sensitive salt. When the ovals coincided, the molecule was supposed to be in the ordinary state, but after light acted upon it for a certain time the ovals occupied the positions shown in B, and after a further action of light they occupied the positions shown at C, in which it again became incapable of proper development, and gave rise to what was known as *solarisation*, the part of the "*latent image*" formed by these solarised molecules refusing to *develop*. By solarisation was meant the phenomenon which occurred (more especially if silver films containing iodide were used), when any portion of the plate received a lengthened exposure to any very bright part of the lenticular image, such as to that of the sky. In solarisation we have have a term which is as unmeaning as is "polarisation" in some of its applications, but since it has passed into the technical language of photography, we are bound to employ it. By the term latent image was meant the invisible (and usually) developable image impressed upon a sensitive film, and it will be used, where convenient, with the reservation once for all, that its applicability is not admitted any more than is the term "developer," as applied to a solution which may cause the deposition of metallic silver from a solution of silver nitrate; since such a solution is effective whether applied to an exposed sensitive film or not. The advance of photography has literally been impeded from the neglect of using accurate language. As regards this peculiar condition which the molecule was supposed to have attained after its impact with light, there seems to be no ground for its adoption. The idea seemingly arose from a supposed necessity which existed for a difference in condition between the visible and the

FIG. 1.

merely developable image. By a strictly logical inference there need be no difference between the two beyond this that there should be a difference in the number of molecules absolutely altered, and in no other respect. Perhaps the most telling experiment giving *direct* evidence of the similarity of the two images was that made by Poitevin, in which he proved the dissociation of iodine from silver iodide, by placing metallic silver in contact with the film. After exposure to light, on separating the two, he found that the latter had absorbed iodine, as proved by treating it with mercury vapour. The *circumstantial* evidence of the truth of the chemical theory of the invisible image, however, is so strong, that on that alone we are bound to accept it, at the same time we are not prepared to say that there are not other physical forces which must play a part in its development; in fact, it must be so. We may say, then, that at its *first formation* the developable photographic image is formed by the reduction of the sensitive compound to one of a less complex nature. Thus, silver chloride (argentic chloride) is reduced to silver sub-chloride (argentous chloride) with the liberation of chlorine; and silver bromide to silver sub-bromide with the liberation of bromine; and so on.

We must now allude to the development of the photographic image. We may divide the methods of development of the image on silver compounds into three: (1) The condensation of mercury; (2) the deposit of metallic silver from a soluble salt of silver by means of a reducing agent such as ferrous sulphate; and (3) the reduction of the sensitive salt of silver itself to form the image.

The first method is the earliest, dating from the discovery of the Daguerrotype process, and till within very recent times the reason of its efficacy has been a subject of controversy. Quincké has lately thrown a light upon

it in one of his memoirs, and his explanation seems to account for it in a most perfect and philosophical manner.

In the Daguerrotype process, it will be remembered, a silvered plate is subjected to the vapour of iodine (or of iodine and bromine), and thus receives a fine layer of a compound which is sensitive to light. When a plate so prepared is exposed to a lenticular image in the camera, the light causes the iodide (or bromoiodide) of silver to throw off iodine (or this together with bromine), which is immediately seized by the silver beneath, and thus forms a deeper layer of the sensitive salt. The depth, almost immeasurable though it be, depends on the intensity of, and length of exposure to, the light. (That this is the case has been proved by the fact that, if the sensitive layer be removed by a suitable solvent, the surface beneath is shown by reflected light to be etched to a greater or less degree.) The invisible image thus formed is exposed to mercury vapour, and the dew condenses on it proportionately to the depth of the layer. Quincké, in his memoir "On the Edge Angle and Spread of Liquids on Solid Bodies,"[1] shows that the edge angle of a drop of liquid on a solid body varies from zero to a constant quantity, according to the thickness of any fine layer of impurity which may be on the latter. When this layer attains a certain value then the edge angle of the drop will remain constant. The thickness, or rather the thinness, of the layer may be appreciated when it is stated that it bears a relation to what is called "the radius of the sphere of sensible action of molecular forces," and is usually greater than '00005 millimetre. In this case the sensitive plate is the solid body and the invisible image forms different thicknesses of impurity. By this difference in the edge angles of the mercury dew, condensed on different portions of the latent image, the light is reflected in different ways, which gives rise to the visible image.

This explanation entirely does away with the necessity, which previously seemed to exist, of the silver iodide (or bromo-iodide) being reduced to the metallic state, in order to cause condensation, or—perhaps it might be said—to cause the formation of an amalgam of mercury and silver.

The next method of development speaks for itself; the metallic silver is deposited in fine granules and is attracted by the salt which has been altered by the influence of light. Perhaps further investigation will show that development is dependent on what is known as the Brownian movement, or the rapid movement of small suspended particles in a liquid. If this movement be dependent on the electrical condition of the neighbouring body, as has lately been supposed; and if, as Dewar has shown, the condition of an exposed sensitive salt is electrical, then the deposition of the metallic particles of silver on the image is accounted for in a satisfactory manner.

The last mode of development is principally employed with silver bromide, and is known as the alkaline method. When a film of collodion or gelatine holds a sensitive salt on a plate, the portions exposed to light are reduced to the metallic state by the application of an oxygen absorbent such as alkaline pyrogallic acid. Since the image is invisible, it must be remembered that but a few molecules of the sensitive salt are reduced by the action of light to the less complex and developable form, we therefore must look for some further action between the developer and the rest of the unaltered compound. It has lately been proved that silver bromide or silver chloride cannot exist in *close* contact with metallic silver. It invariably forms the developable salt. Thus if we take a glass plate, silvered by any of the well-known processes, and expose it to the fumes of bromine or to hypobromous anhydride, it will be found that it is impossible to secure a film of argentic bromide until the last trace of silver has been attacked, after which the true colour of argentous bromide gradually gives way to the well-known colour of argentic bromide. We may try the experiment with bromine water and the same holds good. The action of chlorine on silver is the same as of bromine, but the action of iodine seems to be different, the fully saturated compound, argentic iodide, being formed at first. In other words, this compound is the more stable than argentous iodide.

Now the alkaline developer, when mixed with a soluble bromide of an alkali, has the property of much more readily attacking the argentous than the argentic bromide, presumably because the soluble bromide used in development combines with the former, giving rise to an apparently difficultly reducible compound, whilst it refuses to combine with the argentous salt. It is thus easy to see, if this property of the developing solution be connected with what was stated in the preceding paragraphs, how development takes place. The developer is applied to the exposed film, and the minute quantity of argentous compound is reduced to the metallic state, and at once this particle of silver which is in close contact with the unaltered compound combines with it and forms new argentous bromide. This is ready for attack by the developer, and thus the action spreads till the whole thickness of the sensitive salt is reduced to the metallic state where the greatest exposure has taken place. An interesting result[1] of this action is afforded by the fact that, if a film of unexposed argentic bromide be superposed over one that has been exposed, the image impressed on the latter can be developed in the former so long as close contact is secured. It has been said that this action is due to the solubility of the silver-bromide used in the alkaline development; and, to some extent, this is true; but it is evident that this cannot be explanatory of the whole phenomenon, since the same effect is produced by using, with the pyrogallic acid, potash as the alkali in which the silver-bromide is absolutely insoluble. We have been thus particular in showing the cause of this alkaline development, as it explains some phenomena to which attention will subsequently be called, and which otherwise would be inexplicable, except by reversing usually-accepted physical laws.

W. DE WIVELESLIE ABNEY

(*To be continued.*)

[1] *Phil Mag.*, May and June, 1878.

MILITARY BALLOONING

THE matter of ballooning for military purposes appears to be once more attracting attention in this country. In France they have now a properly organised service under the command of a colonel of the National Engineers, who considers all novelties and proposals as they arise, and who sees, moreover, that the State has always a body of skilled aëronauts at its disposal. At the end of the Paris siege the Postal department, it may be remembered, possessed a large number of balloons, and these being handed over to the French war minister, constituted the *matériel* necessary in the formation of a military balloon service. Col. Laussedat, whose name as an energetic officer of the French Topographical Department, is well known, was placed in command, and he at once secured the services of one of the Messrs. Goddard to put the whole of the apparatus in a fit condition for service. Since that day ballooning in France has been considered as much a duty of the Engineers of the army as telegraphing and surveying, and classes both for officers and men are held for instruction. Lately, by the resignation of Col. Laussedat, the French balloon service has lost its chief support; but his place has just been supplied by Gen. Farr, who will, no doubt, take measures to maintain the high efficiency which has been attained by his predecessor.

In France, as in this country, the balloon is chiefly

[1] *Phil. Mag.*, January, 1877.

regarded by military men as an important means of reconnoitring. The Paris photographer and aëronaut, Nadar, was successful on several occasions in securing photographic records from balloons, but he never published his *modus operandi;* and the problem of balloon photography is one which still excites a good deal of attention. Mr. Walter Woodbury, the well-known inventor of Woodburytype—the only practical photo-engraving process we know—submitted, during the last war, to the Russian government, a very ingenious method of securing pictures at an altitude. By his plan no one ascends with the balloon at all, and therefore the latter may be of very limited dimensions. It is captive, and twisted into the tethering rope are insulated wires in connection with a camera. The camera is weighted and hung upon a pivot so as to be always horizontal, and a fan attached to the balloon prevents the same from gyrating. It is easy to understand how a lens may be capped and uncapped from below with the aid of an electric current, and the photographs are secured—for a series may be taken at one ascent—upon a length of sensitive tissue which is unrolled for use through the medium of clockwork. The sensitive tissue and roller arrangement is that of M. Warnerke, which is known to all dry plate workers, and which permits of securing pictures without glass. Mr. Woodbury's invention has, so far, been tested only in respect to its photographic properties, but in cases where an aëronaut would run too much risk, or where a large supply of gas is not available, the apparatus would be well worthy of trial.

It is the difficulty of securing a sufficiency of gas for inflation that at present stands in the way of employing balloons in the field. The French balloons are all large ones, for they were constructed most of them for postal service during the siege, and, besides the mails and aëronaut, sometimes carried three passengers. With the exception of half-a-dozen, all the balloons which left Paris had a uniform capacity of 2,000 cubic metres, while one, in which M. de Fonvielle and three other persons travelled from Paris to Louvain, measured 3,000 metres. Such bulky balloons as these are unsuited for the field, where the problem is to send a single observer aloft with the minimum amount of time and trouble. The smallest balloon and the lightest gas for the purpose are what the soldier seems to require, and it is towards these two points that attention has lately been directed by Capt. Templar and the other officers who are just now occupied in the study of aërial navigation in this country. Naturally enough, hydrogen holds out the most promising features as a lifting medium, and it is with this gas that experiments are once more to be made. As our readers remember, the weight of hydrogen is calculated to be 2·14 grains per 100 cubic inches, while air on the other hand weighs 31 grains; and, as the lifting power is represented by the difference between these numbers, it stands to reason that theoretically, a balloon, if filled with hydrogen, need be of but comparatively very small dimensions. Unfortunately, in a practical affair like ballooning, a lot of accidental matters require to be taken into consideration, and two of these are the facts that it is difficult to secure pure hydrogen, and more difficult still to keep it in the balloon envelope when secured. Capt. Templar is sanguine that a 10,000 cubic feet balloon is quite capable of lifting an observer high enough for reconnoitring purposes, if filled with hydrogen, and well-nigh proved his case the other day when he overcame gravity, if he did not rise, with the aid of a light coal-gas with which this small balloon was filled. The coal-gas, specially manufactured for his balloon, had a lifting-power of 50 lb. per 1,000 feet, so that a total of 500 lb. was here at his disposal. As we have said, this was insufficient for an ascent, for, besides the weight of the aëronaut, there are, it must be remembered, envelope, car, tackle, cable, and ballast to be taken into consideration. Instead of 500 lb., hydrogen of the same volume would have supplied a lifting-power of 700 lb., and this of course would have been ample, and to spare, for an ascent.

To make this hydrogen recourse will be had, as in previous experiments undertaken by our military authorities, to the decomposition of water in the form of steam. The latter is to be passed through tubes filled with iron filings or turnings, and these, in becoming oxidised, set free the hydrogen. Unfortunately the hydrogen obtained in this way is impregnated with moisture, and unless submitted to the action of some desiccating agent like quicklime, for instance, is of little good for ballooning. The hydrogen it is proposed to obtain in the field, at any rate, in this fashion, and it remains to be proved whether Capt. Templar and his colleagues can secure it sufficiently pure and in proper quantity under these practical conditions. Although hydrogen is given off fast enough at the outset, previous experimenters have found the supply to fall off rapidly, for as soon as the surface of the particles becomes oxidised the decomposition of the steam ceases.

But perhaps the most interesting feature of the present ballooning experiment will be the trial of compressed gas. As our readers know very well, compressed gases are now a commercial article in this country, and you may purchase cylinders of oxygen or hydrogen at twenty atmospheres pressure. As our Royal Engineers carry about with them in the field such unwieldy things as pontoons, they can hardly grumble at a waggon load of hydrogen tubes, and with these it is suggested to fill a balloon just wherever a reconnaissance is to be made. On nearing the enemy the first convenient spot will be chosen for the manufacture of the hydrogen, and this will then be compressed, with the assistance of suitable apparatus, into the tubes, to be drawn off again when the ascent is to be made. In this way there is always to be gas at hand not only to fill the balloon but to keep up a constant supply for a limited period, since hydrogen, under the most favourable circumstances, rapidly exudes from a balloon envelope.

A military balloon, it appears to be decided, must be a captive one, and opportunity would of course be taken to place the observer in electrical communication with the earth through the medium of insulated wires twisted round the rope in the same way as in Mr. Woodbury's photo-aërial apparatus above described.

H. BADEN PRITCHARD

HYPNOTISM

THE phenomena of "hypnotism," "mesmerism," or "electro-biology," have of late years excited so much popular interest—not to say popular superstition—that their investigation by a competent man of science will appeal to the sympathies of a wider public than the purely scientific. My object, therefore, in writing the present article is to give a brief review of a monograph on this subject, which has just been published by the well-known physiologist, W. Preyer of Jena.[1]

In order to eliminate all possible effects of the imagination, Preyer performed his experiments only upon animals, and he begins his paper with an historical sketch of previous investigations of a similarly restricted nature. First we have the "Experimentum mirabile" of the Jesuit Athanasius Kircher, published by him in the year 1646.[2] This consists in taking a common fowl, binding its feet together, and placing it on a floor. As soon as it has ceased to struggle a straight line of chalk is drawn from the point of its bill along the floor. If the legs are now

[1] Die Kataplexie und der thierische Hypnotismus. (Gustave Fischer, Jena, 1878.)

[2] In a postscript Preyer states that he has found this experiment to have been published ten years earlier, by Daniel Schwenter, and the quotation which he makes from Schwenter's book goes to prove that Kircher probably derived his knowledge of the experiment from that source.

untied the fowl makes no endeavour to escape, but remains as it were transfixed, and refuses to move even when urged to do so. Preyer observes in passing that the chalk line constitutes no essential part of the conditions, inasmuch as a fowl may be equally well thrown into a state of hypnotism by simply holding the animal for a short time upon the ground so as forcibly to prevent struggling.

After Kircher no one seems to have investigated the phenomena of hypnotism, or, as Preyer calls it, kataplexy, till the years 1872-73, when some articles on the subject were published by Czermak. The most striking of his experiments were those which he conducted on invertebrated animals—crayfish, for instance, being made to lie on their backs motionless, or even to stand upright upon their heads. Czermak endeavoured to account for the facts which he described by supposing that in some way or other the act of fixing the eyes upon a certain object, or of gazing into space, caused the animals to become sleepy and stupefied.[1] So vague an explanation could scarcely in any case be entitled to rank as a physiological hypothesis, and Preyer showed, in 1873, that the act of gazing had nothing to do with inducing the state of kataplexy, inasmuch as animals fell into exactly the same state when their optic nerves were divided, or their eyes covered with a hood—provided that their bodies were at the same time held in some unnatural position. Preyer therefore propounded a theory of his own, which, as first published, was that the state of fear into which the animal is thrown by being held in some unusual attitude serves to inhibit the power of volition and so of spontaneity—the animal, therefore, when released remaining statue-like in the position in which it was placed. In order to sustain this theory Preyer pointed to other cases in which fear serves to inhibit spontaneity—as, for instance, the motionless horror which some animals exhibit in the presence of great danger, the fascination of birds by snakes, &c. The theory as thus stated was very justly criticised by Heubel, who, in 1876, published a paper detailing his own researches on the subject, and seeking to identify the state of hypnotism with that of ordinary sleep. The effect of this criticism was to make Preyer state his theory with greater clearness, and as we now have it (1878), it seems to be as follows. Any "sudden, strong, unexpected, and unusual stimulation of centripetal nerves" produces an emotion of fear, which in turn produces some inhibitory effect on the will, and eventually a state of stupor. It may, I think, still be questioned whether this theory is of very much value, for even granting that "deathly terror" is always present—which it certainly need not be when the subject of the experiment is a human being—we are not acquainted with any other facts which would lead us to connect the subsequent state of motionless stupor with the preceding state of active fear.[2] But, passing on to the facts, we soon find that an important exception must be taken to the above statement as to the conditions under which hypnotism occurs, for various experiments proved that "sudden, strong, unexpected, and unusual stimulation" of any of those "centripetal nerves" which minister to the *special senses*, so far from inducing a state of hypnotism, instantly aroused an animal which had been previously thrown into that state. So that, in point of fact, as we are afterwards told, we may more correctly state the conditions which produce kataplexy in animals, by substituting for the words "centripetal nerves" in the above-quoted proposition, the words "nerves of tactile sensation." But here I may observe that, so far as the experiments go, there is nothing to prove that special stimulation of even the cutaneous nerves is necessary (indeed thermal and chemical stimulation of the skin was specially tried and produced no results); and therefore, it seems to me, the possibility is not excluded that the special stimulus in question may really have reference only to the "muscular sense." At any rate, all these experiments go to prove that kataplexy can only be produced in animals, either by suspending them in the air, or by forcibly holding them in some unusual position. Most animals recover their normal state after a few minutes, but frogs when suspended in the air will continue kataplectic until they die. Horses become kataplectic while they are being swung from wharves to ships, as shown by the fact that they remain passive so long as they are suspended in the air, but again begin to struggle so soon as their feet touch the deck. Preyer has succeeded in rendering kataplectic various species of toads, newts, frogs, ducks, poultry, pea-fowl, partridge, sparrows, mice, guinea-pigs, rabbits, &c.; but has uniformly failed in the case of many other animals. On the whole he concludes that while among sundry species of reptiles,[1] batrachians, birds, rodents, and ruminants, the phenomena of kataplexy may be more or less easily produced, such is not the case with fish and the more intelligent mammals. Nevertheless in another part of his memoir he attributes to a state of partial kataplexy the period of motionless delay which is observable in children after they unexpectedly fall and before they begin to cry. He also states, on the authority of Dr. Genzmer, that a squalling child (not a young baby) may often be quieted by laying it upon its stomach, or by gently pressing its face with the hand—care being taken in neither case to interfere with the breathing.

Our author further maintains that the so-called "shamming-dead" of certain species of *Articulata* when in the presence of danger is probably to be attributed to kataplexy. But here, I think, it is difficult to agree with him. That the action in question is not a properly so-called *intelligent* one, no competent person at the present day is likely to dispute; but for my own part I cannot see any evidence to show that it is not of the nature of an instinctive action which has been developed in the way to which Preyer alludes. It being for the benefit of some animals that they should remain motionless, and thus be comparatively inconspicuous in the presence of danger, those individuals which endeavoured to escape would be destroyed, while those which ceased to move would survive. Natural selection would therefore soon fix the artifice of "shamming-dead" as an inherited instinct. To this view Preyer objects that, if we accept it, the *origin* of the instinct is difficult to explain; while on the supposition of the action not being instinctive, but purely kataplectic, there is no difficulty to surmount. But to this it may be answered that there is no more difficulty in explaining the origin of the instinct to remain passive in the presence of danger than there is in explaining the

[1] When we fix our eyes upon a certain object and then alter their adjustment for some more distant point, so that the eyes endeavour, as it were, to look through the object, there is no doubt that after a time a somewhat sleepy feeling may be produced. Some persons, I find, can perform this action more easily than others, and it does not seem to consist altogether in maladjustment. At least I have observed that when the action is performed by persons who can do it well the pupils dilate prodigiously, and this even when the eyes are fixed upon a bright light such as the naked flame of a moderator lamp. As the action is completely under the control of the will, one is thus able to observe the curious spectacle of the inhibition by the will of a reflex which under all other circumstances is beyond the control of the will—the pupils dilating or contracting instantly at word of command, and quite irrespective of the stimulus supplied by light.

[2] Indeed a very remarkable experiment which is detailed further on would seem to show that even in the case of animals the state of fear need have nothing to do with inaugurating the state of kataplexy. The experiment in question consisted in suddenly decapitating a fowl, and while the reflex convulsions were still in progress, holding the mutilated body firmly on its back. The convulsions forthwith ceased, and the headless animal became for a time kataplectic. Unless, therefore, we suppose that the spinal cord is capable of suffering fear, and that it is more alarmed by being held firmly down than by being severed from the brain, we must conclude that a state of fear is no essential antecedent to that of hypnotism.

[1] Preyer does not appear to have himself experimented on any species of reptile, but in another part of his monograph refers in this connection to a very old authority, viz., Moses, whose power of causing serpents to appear like rods he supposes to have been probably due to the sagacious Israelite having known something about the phenomena of kataplexy. But considering the number, variety, and general quality of the experiments which Moses is said to have performed, it would surely be desirable to repeat the one in question before accepting the result as a fact of modern physiology.

origin of any other instinct—that of running away from danger included. Moreover, one of the animals to which Preyer refers, viz., the *Armadillo vulgaris*, not only remains motionless when alarmed, but rolls itself up into a ball—an action which certainly cannot be explained on the hypothesis of kataplexy. The most, therefore, that can be said for this hypothesis is, that possibly in its first initiation the instinct may have been assisted by the occurrence of kataplexy.

The time during which the kataplectic stupor lasts varies in different species of animals, and also in different individuals of the same species. The maximum duration observed in the case of rabbits was twelve minutes; but fowls and guinea-pigs continue stupefied for a somewhat longer time. By watching carefully for the first indications of recovery, and by preventing the voluntary movements in which these indications consist, animals may be kept in a state of kataplexy for an indefinite time. Warm-blooded animals do not suffer from such prolonged experiments; but the latter are fatal to frogs. In mammals the most characteristic features of the kataplectic state, besides that of unconscious stupor, are violent tremblings of the extremities, blinking of the eyes, movements of the jaw and pupils, irregularity of the pulse and breathing, pallor of ears in rabbits, occurrence of defæcation and micturition. On recovery the abnormal state passes off suddenly, leaving the animal bright and brisk as before, and thus, as in so many other respects, the state of kataplexy differs from that of ordinary sleep.

One other point of interest must be noted. Preyer finds that it is impossible to produce the state of kataplexy in any animal that is "newly-born." In the case of guinea-pigs susceptibility to be thrown into this state only begins to show itself during the first week after birth, and then gradually increases through two or three weeks. This curious fact is explained by the hypothesis that the volitional centres—or the centres which are supposed to be affected by kataplexy—require some time after birth to be brought into functional relation with the lower centres.

On the whole, then, it will be seen the facts relating to the hypnotism of animals are much more definite than the theories by which it is sought to explain them; and although we may be prepared to agree with Preyer that these facts in some way depend on certain unusual stimuli acting in some peculiar manner on some inhibitory centre or centres, we must feel that this statement of the case brings us only to the threshold of an explanation.

GEORGE J. ROMANES

HYDROGEOLOGICAL SURVEY OF ENGLAND

FLOODS, or water in excess above ground, form one of two extreme conditions, of which the other is drought, or water in defect below as well as above ground. The requirements of water-supply induce the necessity for storage. Out of these three simple facts arise several intricate public questions. Thus it is evident that, if floods are to be controlled, some one must have authority over the rivers, and inasmuch as floods are intensified by land drainage, that authority must extend over the whole of the watershed area if it is to execute measures of a sufficiently comprehensive character to be effective. As works cannot be constructed without money, it must also have rating powers over the whole river basin for the purpose of raising the necessary funds to cover the cost of such remedial works. But inasmuch as the flooded lands bear a small proportion to the contributary area, that is, to the rest of the watershed basin, the consequent preponderance of influence and capital is largely in favour of the unflooded portions. Therefore, if the case of floods rested for its remedy solely upon the loss sustained by riparian owners, it is doubtful whether the British public would ever be brought to see the desirability of moving in the matter. Drought, however, is felt by an increasing population, whose interest in having a proper water-supply is as deep as can be desired. The public looks to the engineer to provide proper storage, who is thus called upon to unravel at least two of the knots that surround the subject of rivers considered in relation to the storage of water. The first of these is of a purely physical kind, and is simply this: that whereas water for the purposes of water-supply is required at high levels, the pure rain which falls upon the declivities of the watershed area at once proceeds to find the lowest level or the deepest ruck in the valley, down which it courses, along the natural main drain of the basin, and below the level of all possible habitations, to the sea. Therefore, before it can be used, it must be lifted out of this ruck. Here steps in the second difficulty. Some one has a vested right in every yard of this water, and a real or supposed interest in obstructing every attempt to divert any portion of it. Waterworks having rivers for their sources have for these reasons proved too expensive for scattered populations in the past. Nevertheless, when fish was a necessary article of diet, the money and influence were forthcoming to cause the construction of a series of very noble ponds, and subsequently when the manufacture of iron flourished in the south of England, many more were added for the purposes of water power; while in some cases water was diverted from the main channel and carried in an open conduit, as in a mill race, with the same object in view. In the case of canals, much of the best and purest spring water the country contains has been degraded from its higher uses to the purpose of a common carrier, but now that the requirements of the population have changed, and it is no longer essential either for the one purpose or the other, but is wanted for drinking, it should be the aim of the engineer to do for water supply what has been done for water power, but on a more comprehensive and extended scale, viz., to keep the water as high as possible by diverting as much as he can take from the upper tributaries, and causing it to contour as far as possible along the ridges with a view of commanding the largest extent of country by gravitation, and to compensate the main channel by a series of storage ponds. Numerous instances may be found in the lower greensand districts in Surrey, formerly a seat of the iron trade.

As a whole, the country is more largely dependent upon subterranean sources, or upon wells, for its water supplies than it is upon rivers. Inasmuch as every well that is sunk increases by a small amount the storage capacity of the stratum, the tendency is in the direction of a gradual lowering of the water-line. The resources of the subterranean water systems cannot be taxed indefinitely. Under London an elliptical vortex has been pumped out whose dimensions below sea-level are twenty miles long, eight miles across, and 130 feet deep, the total amount of depression at the apex being about 150 feet. Yet we have very recent instances of destructive local floods in the Metropolitan area immediately above this great centre of exhaustion. These two considerations point to the multiplication of wells, coupled with a proper system of replenishment from flood waters, as a means of utilising these natural reservoirs. The restoration of the original levels under London would restore to upwards of one hundred square miles of country their lost property as Artesian areas of overflow, the value of which is such as to confer upon the surface its full value as building land.

Thus, as storage above ground is expensive, and generally in supposed conflict with the interests of rivers, few of the numerous natural sites for reservoirs in England have been utilised, except in some places in the southern counties, where they were dammed up for fish ponds and

water power; whereas storage below ground, excepting tanks, remains for the engineer of the future.

Since, then, the agricultural interest is an irresponsible flood producer, and makes no counter provision for the storage of the water prematurely taken out of the soil; and since existing Conservancy Boards have not the necessary powers to deal with floods; and since the claims of water supply are paramount, and, from being strongest in periods of drought, can only be met by provision from flood waters; and since again many of the subterranean water-systems are being steadily exhausted, it becomes evident that no existing authority has the powers necessary for the successful treatment of the various questions so interwoven.

Whatever shape or shapes this governing body may ultimately take, all authorities who have expressed their views upon these questions are agreed that a preliminary survey of the natural sources of supply is necessary. The collection of these essential premises to successful legislation and to successful engineering works lies within the special province of hydrogeology, which takes up the history of rain-water from the time that it touches the soil. The tangible product of the survey is a map, which shows at a glance the necessities and the capabilities of each river basin. By the execution of such a map and the mere exhibition of the facts, a great stimulus is given to engineering enterprise, and by the establishment of such a survey, as a forerunner to legislation encouraging the construction of all necessary works, and the consequent removal of the feeling of want of scope that has stood in the way of the engineer hitherto, Government will have earned the thanks of the engineering profession and of the nation at large. JOSEPH LUCAS

THE INTRA-MERCURIAL PLANET

WE publish the following three communications in reference to the observations and calculations of Prof. Watson on the intra-Mercurial planet, about the existence of which there now seems little doubt. It will be seen from the third communication that Prof. Watson has been led to slightly alter the place of the planet from that given in the foot-note to Mr. Lockyer's article last week.

Prof. Watson, it will be remarked, refers to a second object, which he considers probably new. The position of the nearest conspicuous star ζ Cancri, at the time of his observation, was in R.A. 8h. 5m. 14s.·4, and declination 18° 0′·9.

The following letter to Mr. Lockyer we referred to in the foot-note (p. 462) last week:—

"*University of Michigan, Observatory, Ann Arbor,*
"*August* 14, 1878

"Since my return I have placed the paper circles on a graduated circle, and have read off the marks made during the observations at Separation. The resulting place of Vulcan differs slightly from that which I inferred from mere estimation at the time of the observations.

"The place which I have now derived I consider to be trustworthy within 5′ of arc. It is as follows:—

Washington Mean Time.	R.A.	Dec.
1878, July 29 ... 5h. 16m. ...	8h. 26m. 54s.	+ 18° 16′.

"You are already familiar with the method which I adopted. If I were to do the work over again I would use the same method. It does not give the place so accurately as it would have been given by graduated circles and verniers, but it does away entirely with the uncertainty which might be attributed to an erroneous circle reading at the time. My circles are like the chronographic record of a star transit. They give the pointings for the planet and the sun, and the readings can now be made at will.

"You will be pleased to hear that the planet was seen a few minutes afterwards by Mr. Lewis Swift, who observed in the neighbourhood of Denver. Mr. Swift is known to astronomers by his discovery of comets. I do not know whether he obtained anything more than an estimate of the position; but the place in which it is reported that he saw the planet agrees with my observation. This corroboration is peculiarly fortunate, considering the negative results of other observers.

"JAMES C. WATSON."

The following has been forwarded to us for publication by the Astronomer-Royal:—

"*Keswick, September* 2, 1878

"I have received from Prof. James C. Watson the following communication in reference to the suspected intra-Mercurial planet:—

"*University of Michigan, Observatory, Ann Arbor*
"*August* 14, 1878

"During the recent total eclipse of the sun, I devoted myself to a search for an intra-Mercurial planet. In order to expedite the record of position, I placed disks of cardboard on the circles of the equatoreal, and marked the pointings by means of a sharp pencil and a pointer. All danger of error from wrong circle-readings is in this way avoided.

"In the course of the search, I came across a ruddy star of the 4½ magnitude, which had a perceptible disk, the magnifying power being only 45, and which was in a position where there is no known star. It was very much brighter than θ Cancri, which was seen a little further to the west. Its position was referred, by means of the circles, to the sun, and was as follows:—

Washington Mean Time.	Apparent α.	Apparent δ.
1878, July 29 5h. 16m.	8h. 26m. 54s.	+ 18° 16′

"There was no appearance of elongation such as might be expected if it were a comet, and hence I feel warranted in believing it to be an intra-Mercurial planet The details of the observations I will send you hereafter.'

"Prof. Watson's statement appears to render it very highly probable that the object seen is really an intra-Mercurial planet. I remark, however, that the reason for excluding the supposition of its possible cometary character does not seem quite conclusive, as, when the tail of a comet and the small appendages of its head are invisible, the nucleus is usually circular.

"G. B. AIRY"

The following letter to Mr. Lockyer, just received, contains Prof. Watson's latest statement on the subject:—

"*University of Michigan, Observatory, Ann Arbor,*
"*August* 22, 1878

"On account of a wrong value of the correction to be applied to Prof. Newcomb's chronometer, the place of the new star which I communicated to you last week was erroneous. Please substitute, in place of the numbers then given, the following:—

Planet − ☉

Δα	Δδ
− 8m. 21s.	− 0° 22′

Washington Mean Time.	Planet's Apparent. α	δ
1878, July 29 5h. 16m. 37s.	8h. 27m. 35s.	+ 18° 16′.

"The more I consider the case the more improbable it seems to me that the second star which I observed and thought might be ζ Cancri, was that known star. I was not certain in this case whether the wind had disturbed the telescope or not. As it had not done so in the case of any other of six pointings which I recorded, it seems

almost certain that the second was also a new star. The position comes out

$$\alpha = \odot - 27\text{m. } 18\text{s.} \qquad \delta = \odot - 35'$$

And

Washington Mean Time.	Apparent. α	δ
1878, July 29 5h. 17m. 46s.	8h. 8m. 38s.	+ 18° 3'.

"JAMES C. WATSON"

Our Paris Correspondent writes that Admiral Mouchez has received a letter from Prof. Watson. M. Gayot has completed his calculations and finds that Prof. Watson's observations are in accordance with Dr. Lescarbault's discovery, so long denied by M. Leverrier's opponents.

GEOGRAPHICAL NOTES

THE Geographical Society of Paris took possession, on the 2nd instant, of their new hotel in the Boulevard St. Germain, No. 134. The ceremony took place at three o'clock, under the presidency of Admiral La Roncière Le Nourry, who delivered an address explaining that it was not an international congress, but merely a national meeting of the several French societies, to congratulate their eldest sister on the success which had crowned its efforts. M. Bardoux, the Minister for Public Instruction, who was seated at the right hand of the president, handed the papers of Officer of the University to the architect of the Society. He read a letter from M. de Ferri, the French consul at Zanzibar, intimating that excellent news had arrived from Abbé Debaize, the French explorer, now proceeding towards Tanganyika. The delegates of various French geographical societies afterwards gave addresses summarising the progress which has been made in the work which each is carrying on.

A MAP of France, for which a vote on account of 100,000 francs has been given by the Chambers, is being prepared by the parochial authorities on the scale of 1 to 100,000. It will be hydrographic, not orographic, levels being shown only by curves. Some of it will be issued by the beginning of next year, and two departments figure as specimens in the Exhibition. The road surveyors are to make any alterations from time to time so as to prevent its becoming obsolete. Names, railways, roads, and boundaries will be coloured black; water, blue; woods, green; and footpaths, red.

AN important and interesting discovery has just been made by Dr. A. Kirchhoff in the Library of the Halle University. It consists of a copy of a part of the original diary kept by Capt. Cook during his journey in the year 1772, beginning on July 13, 1772, and ending January 11, 1773. The volume was originally presented to the University by one of Cook's travelling companions, John Reinhold Forster, who died at Halle. Dr. Kirchhoff has communicated the contents of the volume to the Geographical Society of Halle, and proposes to compare the contents with the original diary, should the latter still exist.

M. MAYEFF, who was sent by the Russian Government for the exploration of the routes which lead through the land of Hissar and Amu-daria, has now returned to Tashkend. He has explored and surveyed the routes, 78 miles long, from Djam, a town south-west of Samarkand, to the great town Guzary; and two other routes from Guzary to the passage of the Amu river at Keliff,—one of them 98 miles long, and the other, through Shir-abad, 152 miles. The latter is the best, as there is plenty of fresh water and wood along the whole of the route, as well as two large settlements, Derbent and Ser-ob. At Keliff the Amu-daria is 1,170 feet wide, and steamers can go up the river as far as this place. There remains only 27 miles from Keliff to the Afghanistan town Akhcha, or Andho, and no more than 80 miles of a very good route from Akhcha to Sarypul.

M. PRJVALSKY, who returned some time since from his Central Asian travels, is now preparing for a second journey to Thibet, which was postponed because of the bad state of health of the indefatigable traveller, as well as because of the insecure diplomatic relations between Russia and China.

WE learn that the St. Petersburg Geographical Society and the Society of Naturalists are preparing a scheme for the scientific exploration of the little-known parts of the Caucasus.

THE principal paper in Guido Cora's *Cosmos*, Nos. xi. and xii., is a detailed account by Eugenio Parent of his voyage to Spitzbergen in 1872-73, in the Swedish vessel the *Polhem*.

AN expedition has been organised by the proprietors of the *Queenslander* newspaper for the purpose of making a flying survey of the territory beween Blackwall (Queensland) and Port Darwin, North Australia, a distance of 1,400 miles, with the view of determining the character of the country and the practicability of constructing a trans-continental railway. It was expected that the party would be fully equipped and start from Blackwall on July 12.

IT may be of interest at present to know that *Globus* is publishing the itinerary of Dr. P. Schröder's second journey in Cyprus in the spring of 1873.

AT Duisburg on Tuesday there was unveiled a memorial of Gerhardt Kremer, commonly known as "Mercator," and the author of "Mercator's Projection." Born of German parents in Flanders in 1512, he settled at Duisburg in 1552, and died there in 1594. The first stone of the monument was laid in 1869, but lack of funds delayed its completion.

BREHM'S THIERLEBEN[1]

THESE three fine volumes are in continuation of those reviewed in NATURE (vol. xvii. p. 43), and for the most part they maintain the popular and scientific character of this really great popular work. A. E. Brehm contributes all that was left of the mammalia, and gives a great volume on the reptilia and amphibia. The invertebrata have been wisely placed in the hands of Oscar Schmidt, of Strassburg, the insecta having been already completed by Teschenberg. A. E. Brehm's two volumes comprise nearly 1,400 pages, and they are about the average size of those which have appeared, but the invertebrata (without the insecta) are crammed into less than 600 pages. This is the only great fault we have to find, and it appears to be chronic in every country and under every editorship. The vertebrata take up so much space that the invertebrata must be "scamped;" and the "scamping" is the result not of the editors or authors, but of the publishers. Formerly this unfortunate elaboration of the idea of "first come first served," was limited to human history, and there is a well-known "History of England" which deals largely with the remote past, and which coming to the not unimportant reign of George III. at the close of the book, summarises it with the ejaculation, "whom God preserve!" We might, in a better spirit, say God bless some one who will do justice to the vast invertebrate sub-kingdom in a popular manner.

Oscar Schmidt has had a task of great difficulty to perform in giving anything like a general view of invertebrate life; and when the enormous advance of knowledge,

[1] Die Säugethiere, vol. iii., 1877; Die Kriechthiere und Lurche, vol. i., 1878, von A. E. Brehm; and Die niederen Thiere, von Oscar Schmidt, 1878. (Leipzig: Verlag des bibliographischen Instituts.)

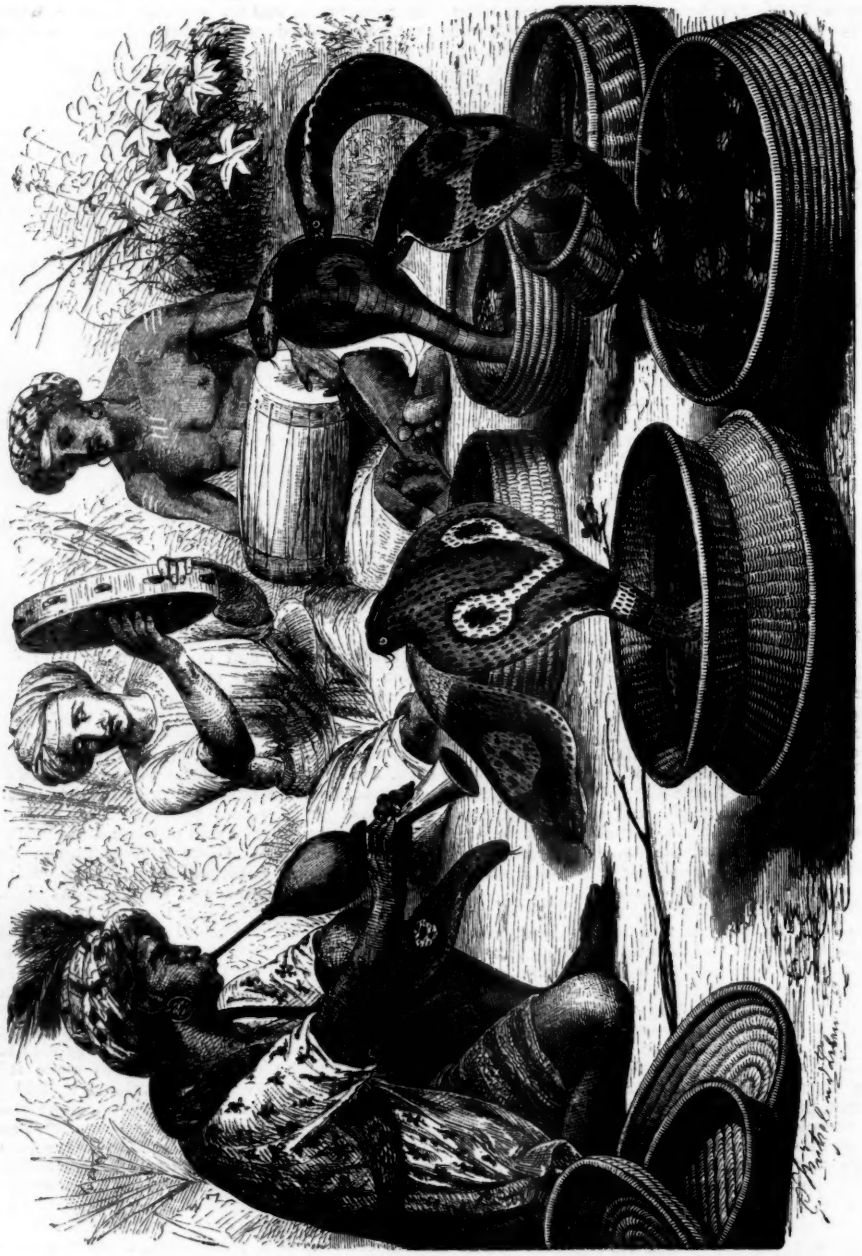
in many orders of it, during the last few years is considered, his contribution requires very equitable criticism. By choosing types of the great groups, by a free use of the observations and sketches made at the Naples and other aquaria, and by some happy selections of the results of the deep-sea dredgings of late years, a very presentable book has been put together. Nevertheless, the book will not satisfy the English reader who is likely to study it. Too good for the great mass of readers, it is so very deficient in the descriptive morphology and teleology of the lowest groups, especially, that the great want of the moderately-educated naturalist is not satisfied. The author's title-page dates 1878, but much of the best work of the world during the previous two years is not introduced. With regard to the authors who are quoted and utilised, there is a curious absence of some of the best English works, and the names of some of the most distinguished naturalists in the world are conspicuous by their absence. We protest very meekly, however, for it is good to be humble as the Germans were ten years ago, and when they did their best work and could think that their fellow-labourers who happened to differ from them were not absolute fools. Another peculiarity of this volume, is the highly diagrammatic nature of some of the views from the life; but it is compensated for by the elegance and artistic grouping of many of the objects in the larger plates, and by the introduction of many novelties. The book commences with the crustacea, the worms follow, the brachiopods and rotifera being in the midst, and the bryozoa concluding the group, and then come the *Weichthiere*, including the cephalopoda, pulmonata, prosobranchia, heteropoda, opistobranchia, and pteropoda. The bivalves follow, and then the ascidia. The great group of the echinoidea is despatched in twenty-four pages. The cœlenterata, including, according to the last morphological craze, the sponges, occupy less than one hundred, and the vast group of the protozoa less than thirty pages. Of this classification the less that is said the better; it is the age of novelties; but there are still some who do not yet fall down and worship the dross metal image Haeckel and others have set up. An interesting figure of the spider crab in its aquarium home gives the peculiar forward droop of the great claws and the daddy-long-legs appearance of the other members: and in another, one of the very opposite dromia group is bedecked with a sponge. A fine plate of pagurids shows one about to change its domicile and another with its usual sea anemone on its protecting shell. There are some interesting remarks on the parasitic amphipods, and the structure and the relations of *Phronima sedenteria* to doliolum and pyrosoma are noticed.

The smaller crustacea are illustrated by the life history and anatomy of Acanthocercus, and there is the queerest transparent *Leptodora hyalina* delineated; and it is to be hoped that it is more truthful than the Paradoxides on the next page but one, which has no facial suture, and whose cephalic shield is out of drawing. The chapter on the cirripedia is poor; and it would have been all the more complete if an abstract of the interesting paper on *Lepas fascicularis*, by poor von Willemoes-Suhm, had been given from the *Phil. Trans.* The successive nauplius stages, the cypris stage, and the absence of the Zoëa, were so splendidly worked out, that any modern natural history should contain them. On the other hand, the huge group of worms is very fully and ably dealt with. Nevertheless, it is to be hoped that some zoologist who may read Schmidt's *résumé* will speedily break it up into reasonable divisions, or rather separate and altogether reorganise the unwieldy, incongruous class. Amongst the rotifera *Notomata mysmeleo* is chosen as a type, and is carefully described and ably drawn from nature by Simroth, to whom the author is frequently under great obligation for exact and artistic illustrations. The exquisite Floscularia, however, is not satisfactorily given, and indeed to do so is hardly possible on wood. The five circum-oral prominences, armed each with a bundle of long protoplasmic filaments, which elongate and radiate, becoming like stiff hairs, and which diminish, become flaccid, and are retired as the creature contracts, are so well known to all observers of pond life, that good indeed must be the draughtsman who can faithfully convey the true impression. The parasitic worms are abundantly dealt with; but we miss the late researches on the land planarians. The general weakness of the chapter on the bryozoa is compensated for by the description and life-history of the extraordinary sponge-dweller Loxosoma, with its schwärm larvæ, and their metamorphosis.

Octopus vulgaris and *Eledone moschata* vie amongst the dibranchiata in ugliness in the illustrations relating to the cephalopoda, but there is nothing very new in the context. Amongst the shell-fish the most interesting forms noticed, are the heteropoda; and the gradation from the shelled Atlanta, whose description and delineation is very good, through carinaria and pterotrachæa to the naked phyllirhoe, resplendent with luminous spots by night, is well done. The pterotracheæ, so translucent and long and shell-less, with their tufted gills and absent tentacles, have evidently been carefully studied at the Naples aquarium, and all about them will be read with much interest. Doris and its neighbour *Ancula cristata*, and the extraordinary *Dendronotus arborescens*, are admirably given. There is much that will be new to the ordinary English naturalist, in the chapters on pteropoda, and the extraordinary larva of pneumodermon will excite as much attention as that of dentalium in the next chapter. Panceri's discoveries of the nature of the luminous organs of pholas are given, and the peculiar phosphorescent secretion is noticed. The chief merit of the chapter on the Ascidia is in the illustrations; but pyrosoma, with its wonderful luminous points, is well described, Panceri again being quoted from. The echinoderms are briefly treated, and the only two points worthy of notice are illustrations, one of urchins in the Neapolitan Aquarium, and the other of a comatula crawling over a sabella, with alternate legs, as is their wont. But there is a curious story in the context, relating to the fipssiarity of *Ophiactis virescens*, a six-armed Ophiurid. From this point the book is too short, and the important groups still unnoticed, are passed over too quickly. Beautiful engravings of hydrozoa, corals, and spongida abound, but the same cannot be said of those of the infusoria and amœba. Acineta is unlike nature, amœba does not show the peculiar head, and *Gromia oviformis* has its pseudopodia too moniliform; the last news about globigerina is not given. Finally, the drawing of the solitary radiolarian is wretched, and pretty noctiluca, with its vacuolated protoplasm, would have been all the better done if Allman had been studied and quoted. There are, however, very few shortcomings in this most interesting volume.

Dr. A. E. Brehm's volume on the reptiles and amphibia is magnificent, and combines good zoology with sufficient morphology and physiology, so as to make it a very useful book. Gustav Mützel, E. Schmidt, and Robert Kretschmer as artists have produced some wonderful plates, and the pages may be opened haphazard and good illustrations are sure to be seen. There is nothing harder to draw truthfully and artistically than a snake, and Mützel's *Morelia argus* (Python punctatus) on page 337 is the best realisation of a huge serpent on a tree-bough overhanging the water, and about to make its rush. When such ophidia partly cling, there is a remarkable flattening and angularity of the body at the spot; elsewhere the trunk may be as cylindrical as usual. This, so well known to the ancient sculptors, has generally been forgotten by modern draughtsmen, who generally draw a snake like a rope. In the instance before us, the truth is

carefully told with an able pencil, and the position of the head in relation to the first few feet of the body is admirably given. Without reflecting on British woodcutters, for they are for the most part beneath artistic contempt, the German engraving is often exquisite. A weird scene, where over water-lilies a moss-grown branch, half hidden in spiders webs and great orchid blooms, supports an angry *Draco rolans*, is capital. A butterfly is settling



Cobra Charming.

down within the creature's reach, but a fellow reptile has made its spring, and with expanded rib parachutes, is about to seize the insect's wing. The mimeticism of plant and animal is so fully developed by the artist, that really one must look hard at the picture before its faithfully rendered details strike the eye. A group of chameleons on a mimosa, one putting out its long club-ended tongue and the others glaring with their bulged

eyes and craftily creeping, is a capital picture to show a troublesome child, for it has the effect of a thorough scare. *Phrynosoma orbiculare*, with its sharp neck and back spines, the hideous moloch all bristling, ptychozoon with its fringes and odd-looking digits, are fairly comparable, in ugliness, with the chelonians, *Chelys fimbriata*, platysternon the big-headed, and the mischievous-looking snake-like tortoises—the hydromedusæ, and the artistic delineations and the descriptions are equal in merit.

The volume commences with a general introduction and then deals with the tortoises. It is interesting to find our White of Selborne quoted, in illustration of the habits of the common pet, and to notice that due credit is given to Darwin and Günther for their notices and elaborate

Horned Frog.

descriptions of the gigantic land-tortoises. The flexible group are introduced by a description of cinixys, and then the terrapenes are described. Clemmys leads on to cinosternum, whose handy-looking beak, and active (for a chelonian) limbs, although small, give a very decided look to the animal. The turtles are noticed, and the curious dermatochelys completes the group. The crocodilia come next, and as it is the least popularly known, *C. acutus* strikes the reader at once. Its marine proclivities in and about San Domingo have so frequently been placed before the learned as indicative that the geological crocodilia were not necessarily fluviatile ani-

mals, that its habits, recorded by Humboldt, are very interesting. The sauria are commenced by a notice of hatteria, and it is to be hoped that by the next edition some one will have learned something of the habits of this extraordinary lacertilian with its dentate crest and back, palatine teeth, biconcave vertebræ, uncinate processes to the ribs and peculiar system of abdominal ribs—the living link with the oldest saurians. The Varanidæ and lizards are profusely illustrated, and Günther's work on pseudopus, more serpent-like, than Sincus in appearance, is noticed before this last genus. Trachysaurus, seps, and the Australian pygopus, might seem reasonably, from outside appearance, to lead to or to be parallel with Chirotes, with its small anterior extremities, and amphisbæna, and to merge into the ophidia. But Brehm has placed between the groups the highly interesting histiurus, chlamydosaurus with its ruff, uromastix, moloch the strange, basiliscus so heraldic in its contour, and the sea-lizard amblyrhynchus. There is a most comical drawing of two platydactyli meeting on a wall, one of them, the intruding party, clinging on to the steep face of a stone by its extended digits. These Gecko species conclude the part.

The ophidia have a very long and interesting introduction, which is more valuable in a natural history sense than in any other; the habits and archæology are capitally given, and some of the popular errors about snakes are exploded, commencing with the non-poisonous set, boa-constrictor and anaconda are given, the latter being rendered especially interesting by quotations from Bates, Humboldt, and Prince von Wied. Xiphosoma, a species of which, figured by Wolf in his usual style under Sclater's auspices, is familiar to us in England, has a spirited engraving by Mützel. It is disturbing the domestic felicity of a cock and hen, and chanticleer is grasped by the shoulder in the fangs of its enemy, whilst the hen is rushing off in dire alarm. The interesting long and slender snake from the Antilles is described with Brehm's usual care, and is drawn in its common position coiled up on a mass of sugar-cane leaves. Then passing on to the pythons, the author commences with a learned paragraph, in which quotations and opinions as to their size and gourmandising propensities are given from Megasthenes and Metrodus, whose vigorous imaginations were outdone by the boa seen by Regulus of one hundred and twenty feet in length. The snake which, in the time of Claudius, was found with a whole child in its stomach, comes nearer the truth. The Indian python (*P. molurus*) is shown strangling, in the folds of the first half of its body, a small ruminant, the hinder half being still on the ground to give a *point d'appui*. The hind-quarters of the prey are being grasped by the jaws preparatory to swallowing. A little further on *Python sebæ* is swallowing a bird: the gape is stretched to the utmost and the muscular tension of the neck is admirably given. There is a long and interesting history of the water snake (*Tropidonotus natrix*) with notices of its hybernation and habits, and the tree-snakes, well illustrated, lead to the water-loving and ugly Japanese achrocordus. The natural history of the poisonous snakes is carefully given, and the researches on the nature of the poison are carried down to the date of Brunton's and Fayrer's work. A large plate of the cobra charming is given. There is a wonderful drawing of *Hydrophis cyanocincta*, with its compressed body, and of the flat-headed, long-snouted sea-snake (*Pelamis bicolor*). There is much interesting information given about the vipers and the rattle-snakes, headed by a drawing of that curious happy family, the prairie-dog, owl, and snake, and the group ends with the genus Bothrops. In dealing with the amphibia, Günther is very generally followed, the hylidæ are elaborately illustrated, and *Nototrema marsupiatum* especially. The Antilles frog (*Hylodes martinicensis*), whose metamorphoses are shortened in the egg in which they have a very short tail, which is lost during the first day of liberty, is described, and then, passing on to the Ranidæ, the esculent form is noticed and figured. A pre-Raphaelite horned frog from the south of the Brazils, the obstetric alytes and the pipæ are admirably drawn and described. There is nothing very striking amongst the urodela, and the gymnophiona are curtly treated. There is no doubt that this volume will be studied by all who can read easy German, and we commend it to schoolmasters who usually teach the language out of the dreariest books.

The third volume of the mammalia, by Dr. A. E. Brehm, includes the horses, the ruminants, proboscidea; tapirs, rhinoscerides, hyracoidea, pigs, hippopotamidæ, and the marine series, and they are contained in nearly 700 large pages. The natural history of these groups is so profusely embellished with illustrations, and so replete with anecdotes relating to the habits, instincts, and methods of capture of the principal types, that it is a true popular encyclopædia of this part of nature. There might be more anatomy and physiology, but, as a book for common reading in all parts of the world, it is most excellent, and well up to the zoology of the day. It is refreshing to be reminded of the old school of zoologists, now almost extinct in this country, whose members, if they did not know all the anatomical minutiæ, the homologies, morphological affinities, and the terribly hard names of, and devoted to, the animal kingdom by modern *savans*, did know the outside appearance, and could tell interesting tales about the beasts of the field. It is true that they had not reached that standpoint where it is necessary to get at the base of the skull of a ruminant before its genus can be told, or to examine the knee, carotid, or some other *post-mortem* matter of a bird before it can be classified. But they could distinguish between living things by their outsides, and had a good idea of the notion of a genus and species from external characters. The horse, of course, affords great scope for Brehm's literary powers, and the archæology and the divisions of the group are well and carefully done. As everybody is the best possible judge of a horse, those who read this part will surely criticise the illustrations. They will please those observers who know the motions of a horse from plates, but they will not pass muster with horse-loving people. There is a cut of *Equus hemionus*, and, evidently from the position of the most prominent of the group, it is about to lie down at full gallop. Next comes a large plate of an Arab of pure blood, a stallion without a single good point about it: its ears are close together, it has small nostrils, and a jowl like a cart-horse; straight shoulders, small, long, upper fore-legs, and a great narrowing of the hock below the knee; it has a long barrel, no end of space between the rib and pelvis, and the off hind-leg is that of a rocking-horse. An Arab is admiring this beast, and an erect Black is probably discounting its value to that of twenty-five pounds. The tail is the best part. On p. 29 a mare and foal are trotting, and the mare is pointing her descending fore-foot after the manner of screws; artists rarely will see that the sound horse tries to get the back of its foot down in the trot, and then never falls. A cut of a quagga shows that this African animal does not require to touch the ground in its motion—motion we say, for whether the beast is trotting, cantering, or larking, it is impossible to say, for the near legs are wide apart, one under the nose and the other under the tail, whilst the off legs are within a foot of each other, and all are in the air. Burchell's horse is, however, properly drawn.

The ruminants will be more interesting to those readers who have not had the advantage of visiting large zoological gardens or of reading the stories of the great African hunters; but there are several types which are uncommon, and which are of much interest. There is nothing particularly new in the other groups, and the works of Murie, Brown, and others, have been carefully abstracted in dealing with the pinnipedia.

P. M. D.

THE PIKERMI AND SIWALIK FAUNAS PLIOCENE, NOT MIOCENE

THE best zoologists are in the habit of calling the mammalian fauna of Pikermi, in Greece, *miocene*. As instances, I may quote Mr. Wallace in the "Geographical Distribution of Animals," p. 118, where it is expressly stated that the mammalian remains in question are "from the upper miocene deposits of Pikermi," and Prof. Flower, in his paper "On some Cranial and Dental Characters of the Existing Species of Rhinoceros," P.Z.S., 1876, in which he mentions, p. 457, "the miocene *R. pachygnathus*, Wagner, from Pikermi."

I had occasion, a few days since, to consult Gaudry's "Animaux Fossiles et Geologie de l'Attique," in connection with the Siwalik fauna—also persistently, but, I believe, wrongly classed as miocene by European geologists and naturalists—and to my surprise I found it shown by the clearest evidence, that this Pikermi fauna occurs in pliocene beds, the age being proved by the occurrence of marine shells at the base of the bone-beds, and by the circumstance that the strata containing both bones and miocene shells rest unconformably on others with miocene plants. The latter fact is less important than the former, the value of plant remains for the determination of geological age being a disputed point, but no geologist hesitates to accept the indications afforded by marine annuals in preference to all others, and the tertiary marine faunæ of the Mediterranean area are particularly well known.

M. Gaudry proposes a hypothesis, *op. c.*, p. 431, to account for the presence of so many miocene forms in pliocene beds. It must not be forgotten that several Pikermi species are identical with forms found in undoubted miocene strata in Central and Western Europe. The theory proposed is briefly that the Pikermi mammals were driven into the hills by the breaking up of the miocene land, and starved to death, when their bones were washed down into the bed with pliocene mollusca. As there must have been, I think, a long interval of time between the deposition of the disturbed miocene beds and the formation of the unconformable pliocene strata, I think the following suggestion is preferable, as it avoids the idea of any sudden change. There is abundant evidence that the refrigeration of the earth's surface, culminating in the glacial epoch, commenced in pliocene times, and this may have led to a southern migration of the mammalia, so that animals which, in the earlier epoch, inhabited Central Europe, at a later period still survived in Grece, although they had been replaced by pliocene forms further north. It has already been shown by various writers that there is a connection between certain miocene faunas in Central Europe and the living mammalia of Africa on the one hand, and of the Malay countries on the other, and I think it not improbable that the remains found in pliocene beds in Greece, and at the base of the Himalayas, owe their miocene affinities to the same facts of migration to which similar affinities may be attributed in the living forms.

The evidence of the pliocene age of the Siwalik is simple. In Sind strata containing miocene marine fossils pass up into beds with a mammalian fauna, including some of the older Siwalik forms, such as *Mastodon*, *Chalicotherium*, *Dorcatherium*, &c., together with *Dinotherium*, *Hyopotamus*, *Hyotherium*, *Anthracotherium*, &c., which have never been found in the true Siwaliks. These Sind beds are apparently equivalent to the lower Siwaliks, which are unfossiliferous in the typical area. In the middle and upper Siwaliks, instead of the old forms just named, *Elephas*, *Loxodon*, cervine and bovine ruminants in abundance, and other recent types are found. Now, as the Sind beds cannot be older than upper miocene, the typical Siwaliks must be pliocene. The mammal *Bos* (*Bubalus*) *palæindicus*, found in the upper Siwaliks, occurs also in the Nerbudda alluvium, where it is associated with palæolithic implements. It is not credible that a mammalian species could have lived from miocene to post tertiary times.

The question of the true age of these later tertiary mammalian fauna is of such vast importance in the attempts now being made by many naturalists to work out the line of descent of living animals that I trust I may be pardoned for calling attention to the preceding facts.

W. T. BLANFORD

OUR ASTRONOMICAL COLUMN

SCHMIDT'S CHARTE DER GEBIRGE DES MONDES.—In the Introduction to the *Erläuterungsband*, accompanying Prof. Schmidt's lunar charts, he has given an interesting account of the progress of his great work, of the difficulties he encountered, and the assistance afforded him in a variety of ways, until the honourable and flattering conclusion. It was in the autumn of 1839, at his native place, Eutin in Holstein, that his attention, at first given to botany and zoology, was directed to the moon, by the circumstance of a copy of Schröter's work having come into his hands through a sale by auction. The engravings of the numerous craters and mountain-shadows made so strong and lasting an impression upon his mind that he appears to have resolved to make the study of the surface of our satellite the principal aim of his life. At fourteen years of age the possession of a small draw-telescope, constructed by his father, enabled him to commence his observations of the lunar features, and his first sketch was one of the well-known streaks of Tycho, made with this instrument, which was supported against a street lamp-post! A stand being subsequently provided, he began to draw whole phases, in which Mayer's charts were found of service. Thus he observed in 1840, his school studies, as he tells us, suffering thereby not a little. As so often happens in similar cases, young Schmidt's peculiar bent attracted the attention of one who had the disposition and the means to aid him, and State-Councillor Hellwag, a highly-educated man, with advanced knowledge of astronomy, provided him with a very perfect telescope by Dollond, and with it he observed at Hellwag's house. In July, 1841, he saw the moon for the first time in a large telescope, Petersen, assistant to Schumacher at Altona, having shown him the crater Gassendi and Bullialdus. He then learned first, as he says, the richness of the lunar formations, the more that he became acquainted at this time with the large chart of Mädler. In 1842 Schmidt went to Hamburg, and obtained access to the observatory under Rümker's charge; here, through the good-will of the director, he made use of various telescopes in furtherance of his lunar work during the years 1842-45. In June, 1842, he was also assisted by Herr Bartels, of Hohenfelde, near Hamburg, who allowed him the use of his telescope, and it was at this time that he made the earliest drawings which proved available in the construction of his great chart. In 1845 he went to Bilk, near Dusseldorf, the site of Benzenberg's observatory, but his progress was slow here, the principal instruments originally in the building not being then serviceable. During his residence at Bonn in connection with the observatory presided over by Argelander, this continued to some extent, the regular work of the establishment claiming attention; nevertheless in the period 1845-1853 he obtained sketches which proved of value, with written descriptions of many of the features of the moon's surface. On several occasions during this interval, by the encouragement of Profs. Galle and Bruhns, he had opportunities of making drawings with the aid of the Berlin 9-inch refractor. From 1853 to 1858, Schmidt had charge of the observatory of Herr v. Unkrechtsberg, an ecclesiastic at Olmütz, and here he undertook micrometrical measures for determining the heights of the lunar moun-

tains, &c. In March, 1855, visiting Rome, he made sketches with the large refractor of the Observatory of the Collegio Romano, and in the following month delineated many of the lunar landscapes with the telescopes at the Observatory of Naples. In December, 1858, he entered upon his present position as director of the Observatory of Athens, but from the state of the institution and the instruments, observations were not practicable for nearly a twelvemonth, so that it was only in November, 1859, that he was able to use, for his work on the moon, the 6-feet Plössl refractor, with which so much of the remainder of his long-continued labours has been completed.

In January, 1865, he formed the project of preparing a lunar chart, but his experience upon it for a considerable time was not satisfactory, for reasons which he details. In April, 1867, his final resolve was taken, and setting aside the results of his previous attempts at the construction of maps, he chose for his scale a 6-feet diameter, and, after the example of Lohrmann, arranged to subdivide his chart into twenty-five sections, as it has appeared. The work proceeded steadily until, in 1873 and 1874, those parts of it not strictly topographical and the colouring were completed.

In December, 1874, Prof. Schmidt proceeded to Berlin with his chart, for the purpose of exhibiting it to the authorities, astronomical and otherwise, in that capital. The interest which it excited here led to a fortunate combination of circumstances, through which the editing of the work was secured under the protection of the State, and the Crown Prince was instrumental in procuring the publication of the chart. At the suggestion of the Prince, the twenty-five sections were photographed in the department of the General Staff, and in April, 1875, Prof. Schmidt received from Field-Marshal Count von Moltke proofs of the same, which enabled him to bring the descriptive portion of his work to a close, while the original charts were retained at Berlin.

Such is a brief outline of the history of an astronomical undertaking that has occupied a lifetime. We must refer the reader to the explanatory volume for further interesting particulars of its progress and vicissitudes while under construction, at the many stations where its talented and indefatigable author has been located—from Altona to Naples.

NOTES

MORMONISM, whatever we may think of it as an institution, is so far in harmony with the times as to appreciate the value of scientific investigation; and its leaders seem to be heartily desirous to do what they can to further its interests. A recent number of the *Deseret News*, the leading organ of the Church party in Salt Lake City and Utah Territory, contains an account of the reception by President John Taylor, the successor to Brigham Young, of Dr. Thorpe, of the Yorkshire College, Leeds. Dr. Thorpe, accompanied by Dr. Schuster and Mr. Haskins, of St. John's College, Cambridge, is making a series of magnetic observations across the American Continent along the line of the Union Pacific Railroad, and Salt Lake City was selected as one of the stations. The president evinced considerable interest in the work, and showed a great desire to be informed respecting its character and objects. He offered to assign any spot within the city which might be deemed most suitable for the observations to the party, placed the transit instrument in the Tabernacle yard at their service, and suggested the laying of a special wire from his private telegraph office to the observatory for the purpose of exchanging time-signals with Prof. Safford, who is determining longitudes at Lieut. Wheeler's base station at Ogden. With such facilities the magnetic elements of Salt Lake City ought to be accurately known.

PROF. STRUVE, director of the Pulkova Observatory, is leaving Russia for a visit to Western Europe, for the purpose of giving directions for the construction of a new great refractor for the Pulkova Observatory. The old refractor, which some time ago was one of the best in the world, is now behind those of Washington, Chicago, and Gateshead (Mr. Newall's Observatory), and the Pulkova Observatory, according to the will of its founder, the Emperor Nicholas, should be maintained superior to all other observatories in that direction.

WE regret to announce the death, on August 15, at Kiel, of Prof. Emil von Asten, of the Pulkova Observatory, at the early age of thirty-six years. A pupil of Argelander, he is known by several remarkable researches,—as the investigation into the orbits of Uranus, and especially by his researches into the motion of Encke's comets with regard to the existence of a resisting medium. After ten years' study of the subject, he published a series of "Memoirs," in which he proved the existence of a medium, and showed why its influence could not be observed on other comets, as, for instance, that of Faye. His "Memoirs" have given rise, as is known, to one of those remarkable suggestions of Prof. Mendéleeff, as to the physical properties of this medium. Prof. Asten was, besides, one of the most valuable calculators of our time, and many of the Pulkova observations were reduced and calculated by him, or under his direction. His work on the sum of temperature, necessary for the development of several plants of the flora of St. Petersburg, was done during his leisure hours, as well as his discussions on the philosophy of Schopenhauer and Hartmann, of whom Prof. Asten was an admirer.

M. FIZEAU, the present president of the Paris Academy of Sciences, has been appointed to the Bureau des Longitudes, to fill the place vacated by the death of M. Leverrier.

WE have received the programme of a singular propaganda which seems to have been suggested by the recent opening up of the East to Western influences, and to which we cannot but wish all success. The circular is issued by M. C. Constant, of Smyrna, a member of the Asiatic Society of Paris, and his scheme is to form a society for the publication in Armenian of cheap popular scientific works, as one of the best means of enlightening and developing the people of the East, and of forming a bond of sympathy and union between those of all creeds. It is wished to implant in the East the great principles of the Experimental School, which form the greatness of the West. Special attention will be given to anthropology and the social sciences, which constitute the great problems of the age. The Eastern peoples are at a turning-point in their career, M. Constant says, and they ought to be prepared for the only definitive conquest to which they will submit sooner or later, "the conquest of science, that first European power." The proposed "Eastern Scientific Library" will be begun by the publication of an introductory volume treating of the positive method and its history; it will be a summary exposition of the intellectual evolution of humanity, from pre-historic times to the present. M. Constant makes appeal to the scientific societies of Europe for aid in this enterprise, and communications should be addressed to him as above.

THE Iron and Steel Institute holds its summer meeting at Paris this year, on September 16, 17, and 18, at the rooms of the Société d'Encouragement, 44, rue de Rennes. Besides the Introductory Address by the President, Dr. C. W. Siemens, papers will be read by Prof. Jordan, Paris, On the Mineral Resources of France; by Prof. Richard Akerman, Stockholm, On Some Studies Relative to the Present State of the Iron and Steel Manufacture, made at the Paris Exhibition; by Mons Euverte, Terre Noire, On Homogeneous Steel; by Danie Adamson, Manchester, On the Mechanical and other Properties of Iron and Mild Steel; by Mons. Marché, Paris, on Certain

Aspects of the Steel Manufacture; by J. S. Périssé, Paris, On the Ponsard Furnace for the Manufacture of Steel; by Sydney G. Thomas and Percy C. Gilchrist, Blenavon, on the Elimination of Phosphorus from Pig Iron in the Bessemer Converter; by R. P. Rothwell, New York, On the Low and Strong Water Gas Processes. Visits have been arranged for to the works of Creuzot, of Terre Noire, and of Hayange, Lorraine.

THE scientific facilities of Zürich are to be increased by the erection of a magnificent new chemical laboratory for Prof. Victor Meyer. For this purpose the cantonal government has granted an ample site and the sum of 600,000 francs, which amount will be increased by appropriations from the city. Prof. Meyer, although but 30 years of age, is one of the most popular and well-known professors of chemistry of the present day, and his present laboratory is thronged with students of various nationalities.

WE intimated some time since that a wealthy Danish brewer had set aside the sum of a million Danish crowns for the support of a laboratory in which to carry on scientific research. The first report of work done in this laboratory has just been issued under the title of "Meddelelser fra Carlsberg Laboratoriet" (Copenhagen, Thieles Bogtrykkeri). It is in Danish, with an abstract appended in French. The founder of the fund, from the application of which so much of scientific interest and technical value may be expected, is Mr. J. C. Jacobsen, a Danish gentleman who owns a large brewery in the neighbourhood of Copenhagen, and who is well known and honoured in his own country for his patriotism and for his intense love of science and art. The Carlsberg endowment is only the last of a series of munificent gifts to his country, or rather to the whole civilised world. The fund itself, as we have said, consists of one million Danish crowns, or about 56,000*l.* English. This sum is vested in the hands of five persons, who are nominated by the Danish Royal Academy of Sciences. A portion of the annual revenue is to be expended in keeping up the splendid laboratories attached to the brewery, in which chemical and physiological researches are carried on with a view to establishing as complete a scientific basis as possible for the great industries of brewing and malting. The other portion will, after the death of the donor and his wife, be expended in the advancement of the various natural sciences, mathematics, philosophy, history, and philology. In the administration of this latter portion much latitude is very properly allowed to the trustees of the fund, who will be enabled to apply it in almost any way they think proper. It becomes, in fact, a veritable research fund for all branches of science. The statutes of the fund will well repay a careful examination. The endowment has now been in force for something like two years, and the report embodies the results obtained in the laboratory during that period. The papers are of different degrees of value and interest, but on the whole form a very respectable contribution to our knowledge of the subjects on which they treat. A correspondent writes that last year he had the opportunity of inspecting the magnificent laboratories of Carlsberg, and was much struck with the complete and luxurious manner in which they are fitted up, and with the good style of work that was being carried on in them. The Report contains papers on the following subjects:—"On the rotatory power which beer-wort exercises on polarised light, and on its variations during fermentation," "Estimation of extract," and "Estimation of alcohol in beer," by M. J. Kjeldahl; "Researches on some factors which affect the propagation of the low yeast of *Saccharomyes cervisiæ*;" "On the influence which the introduction of atmospheric air into fermenting wort exercises on fermentation;" and "Researches on the influence of temperature in the production of carbonic acid on barley germinating in darkness," by M. R. Pedersen.

MR. F. A. OBER, who has been engaged for several years in prosecuting investigations into the ethnology and archæology of the West India Islands, under the direction of the Smithsonian Institution, reached Martinique in the beginning of July, where he proposes to continue his labours. He has already explored the islands of Dominica, St. Vincent, Santa Lucia, Antigua, and Tobago, and has sent home a very good collection of the birds of these islands, including quite a number recently described by George N. Lawrence as new to science. He has also supplied many archæological objects of considerable interest. A list of the birds of Dominica and St. Vincent, prepared by Mr. Lawrence, is published in the *Proceedings* of the National Museum at Washington, and the notices of the remaining islands will soon appear in the same journal. Mr. Ober expects to return o the United States in September or October next.

A NEW meteorological society is in way of formation at St. Petersburg; its special aim will be the extension of meteorological observations in Russia.

THE committee of the Liebig Monument Association at Munich have given their decision regarding the various models sent in for competition. The first prize (100*l.*) was awarded to the sculptor, Herr M. Wagmüller, of Munich, and the second (75*l.*) to Prof. Begas, of Berlin.

THE International Association against the pollution of rivers, the soil, and the air, will hold its second meeting at Cassel on September 9 and 10, *i.e.*, two days before the meeting of the Association of German Naturalists.

THE general meeting of the United German Societies of Archæology and History will take place at Marburg on September 15-19.

AMONG the subjects expected to be discussed at the Social Science Congress at Cheltenham, October 23-30, are the expediency of increasing the number of universities in England, and the desirability of establishing free primary schools throughout the country.

THE Exhibition of Sanitary Appliances and Articles of Domestic Use and Economy, held in connection with the Autumn Congress of the Sanitary Institute of Great Britain, will take place at Stafford, from the 2nd to the 19th of October next.

AT Chalons-sur-Saone a committee has been formed for the erection of a monument in memory of Joseph Nicéphore Niepce.

IN the Fourth Report of the Underground Water Committee of the British Association, read at Dublin, Mr. De Rance comments on the scientific and practical importance of the continuance of the experimental well boring just carried to a depth of 1,000 feet, through the pebble beds of the new red sandstone, for the Liverpool Corporation, by Messrs. Mather and Platt. The boring is 26 inches diameter, and if continued, would not only prove the water-bearing capabilities of the new red sandstone, but its thickness, the character of the underlying rock, the nature of the coal-measures beneath, and the possible existence of productive coal-seams, and other questions of not merely local, but national importance.

AMONG the scientific novelties of the German book trade during the past month we notice the following works:—"Praktische Anleitung zum Bestimmen der Käfer Deutschlands und der Schweiz," J. Hoffmann (Stuttgart); "Vier Jahre in Afrika," E. von Weber (Leipzig); "Die Messung des Feuchtigkeitsgehaltes der Luft," Dr. K. Koppe (Zürich); "Theorie der Bewegung des Wassers in Flüssen und Canälen," O. Meissner (Bamberg); "Leitfaden der Physik," R. H. Hofmeis-

ter (Zürich); "Lehrbuch der vergleichenden Anatomie," Prof. A. Nuhn (Heidelberg); "Handbuch der Erdkunde," G. A. von Klöden (Berlin); "Beiträge zur Kenntniss der Orchideen," H. G. Reichenbach, Bd. 3 (Leipzig); "Die Alpenpflanzen nach der Natur gemalt," J. Seboth (Prague); "Die Rose; Behandlung, Zucht, und Pflege," Dr. A. Oehlkers (Leipzig); "Flora im Garten und Hause," H. Jäger (Hanover); "Anatomisch-physiologischer Atlas der Botanik," Dr. A. Dodel-Port (Zürich); "Lehrbuch der Botanik," Dr. C. Baenitz (Berlin); "Die Vögel," D. Kompfe (Leipzig); "Die Raubvögel Deutschlands und des angrenzenden Mitteleuropas," O. von Riesenthal (Cassel).

AT the recent Congress of Hygiene in Paris the National Health Society of London had three representatives. The National Health Society is composed of those interested in sanitary work of both sexes, and deals exclusively with matters affecting the sanitary condition of all classes, leaving medical questions to the doctors, and endeavouring to accomplish "prevention" rather than "cure."

TWO guides and two German tourists recently lost their lives in ascending Cevedole, a mountain of the Tyrolese Alps. One of the victims was Dr. Sachs, the preparator of Prof. Dubois Reymond.

WE would direct the attention of our provincial readers to a useful article in this month's *Science Gossip* on "How to Start a Natural History Society." The directions are thoroughly practical and sensible.

ONE of the most interesting handbooks in connection with the Paris Exhibition is that to the British Indian Section, by Dr. Birdwood, the second edition of which is before us. It contains a great deal of geographical, antiquarian, and historical information, the Introduction treating of the geographical and physical features of the Indo-Germanic shore, on the Settlement of the Old World by the Human Race, the Antiquity of the Indian Trade, Routes of Indian Commerce, and of the Master Handicrafts of India. An Appendix contains much useful statistical information, and the handbook ought to be of permanent value.

THE *Cologne Gazette* gives details of the earthquake of August 26, as observed in that city. The earthquake passed from east to west. About three minutes to 9 A.M., a shaking and rising and falling of the ground, after the fashion of waves, began to be felt, and increased more and more until buildings rocked to and fro in a formidable manner. Tables, chairs, beds, stoves, &c., set up a dancing movement, which became so strong and tremulous that figures and ornaments resting upon them were knocked against one another and thrown down. Several persons declare that they felt as if an electric current were passing through their legs, and as if the earth were withdrawn from under their feet, and a sudden giddiness came over them. In some places the pendulums of the clocks ceased to beat. Towards the end of the vibration, which lasted about seven or eight seconds, there was heard a dull sound like the roll of distant thunder. Several persons state that soon after the first series of shocks there was a second but much lighter one. There was another (a third) shock at 11.10 A.M., which was not equal to the first either in severity or duration. It may be remarked that no fall of the barometer was observed to follow the earthquake. An interesting observation was made in the neighbourhood of Muhlheim on the Rhine:—"A very distinct curl was seen to cross the river obliquely, from south-south-west towards north-north-east, quite undisturbed by the current, while at the same time a deep roar of the water was heard. Even still (the afternoon of August 27) there is an audible rattling of the panes of glass, and domestic utensils, if close together, knock against one another, while a dull rolling sound is heard." The earthquake wave was felt from Hanover and Utrecht to Mayence in the south. The motion was sensible at Brussels and Liége, as well as Bonn, Cologne, and Aix-la-Chapelle. Some papers state that a seismograph at Cologne has proved the shocks to have had a duration of three-quarters of a minute.

IN the night of August 21–22 a meteor was seen to fall on a house in the vicinity of Butzbach, a small town in Hesse. On the following morning a small polished dark stone was discovered on the spot, and will be sent to the Berlin Museum.

IN consequence of the annexation of Alsace and Lorraine, the piscicultural establishment of Hüningen, which had been founded by the French government in the year 1852, passed into the hands of the German government, which, since 1871, has bestowed the greatest attention on the establishment, and spared no cost to make it as efficient as possible. Recent statistical reports state that the establishment, while under German control, has sent away no less than 23,500,000 ova of various species of fish, such as trout, salmon, carp, roach, &c. Some two million young salmon have been placed in the Rhine, and a similar number of other useful fish into the rivers of Upper Alsatia. The result has been that fish are now plentiful in those waters, that the rents paid for fisheries have considerably risen, that salmon can now be bought at about 6*d.* per pound in that neighbourhood, and that the time seems to have returned when fish was in those districts a cheap food for the people.

A NOTABLE improvement in watches is reported from Chaux de Fonds, Switzerland. By a peculiar process the figures on the dial are rendered luminous, so that if exposed once during the day to the sunlight they remain phosphorescent and visible throughout the night. Preparations are being made for the production of these watches on a large scale.

THE International Association for obtaining a uniform decimal system of weights, measures, and coins is holding a Congress in Paris at the Trocadéro this week. Though an unofficial gathering, several governments have sent representatives to it. On Monday, M. Tresca gave a survey of the question all over the world, and pointed out that the only countries which have as yet made but little progress are England, the United States, and Russia. It is thought the Congress will be able to agree on the general adoption of the metric system for weights and measures, and perhaps on a 10f. gold piece, nine-tenths fine, as an international unit.

AT the Birmingham Natural History and Microscopical Society's meeting on Tuesday last, Mr. Bolton exhibited the polyzoon, *Cristatella mucedo*, and the grouped rotifer, *Lacinularia socialis;* Mr. Slatter exhibited the polyzoa, *Fredericella sultana* and *Paludicella ehrenbergi;* and Mr. Levick exhibited the infusoria, *Actinosphærium eichornii* and *Spirostomum ambiguum*.

AN interesting series of experiments was lately instituted by Herr Muntz, in order to determine whether the living cells of the more highly organised plants, when entirely cut off from oxygen, are equally able, with the cells of fungi, to produce alcoholic fermentation. For this purpose he experimented with a variety of plants, beet, maize, cabbage, chicory, portulacca, nettles, &c. From each kind three equally healthy plants were selected. One was left in the open air, and the other two were placed with the accompanying soil, under capacious bell-glasses, containing an atmosphere of nitrogen, the oxygen being removed by pyrogallic acid. After a lapse of from twelve to forty-eight hours, they were removed from the glasses. One was placed in the open air in order to be certain that the power of development was retained after the imprisonment, and the other was cut off above the ground, distilled with water, and tested for alcohol. In all cases the plants which had been in an atmosphere free from oxygen showed appreciable quantities of alcohol, amount-

ing often to a thousandth of the entire weight of the plant, while no traces could be detected in the plant which had remained in the air during the same time In this connection we should mention a detailed account in the *Journal für Prakt. Chemie*, of experiments instituted by Prof. Gunning, of Amsterdam, to settle the question of the ability of bacteria to exist in media free from oxygen. They consisted in inclosing in glass tubes easily decomposable substances, such as raw flesh, green peas, &c., infecting with a drop of a mixture of decayed peas and white of egg, which contains nearly all varieties of bacteria, —closing the tubes by fusion after freeing entirely from oxygen, and allowing to stand for periods ranging from four months to two years. The results of all these experiments showed that by exclusion of oxygen the bacteria were completely destroyed, the putrefaction being entirely stopped, and not continuing afterward, on the admission of filtered air free from bacteria.

THE appearance of phylloxera at Sachsenhausen, near Frankfort-on-the-Main, is officially reported. The appearance of the Colorado beetle at Jaratschewo in the district of Schrimm in the Prussian province of Posen is also reported.

AT Oderberg, in Austrian Silesia, we learn from a report to the Imper. Geol. Instit., March 19, some pile-structures, or rather the floors associated with them, were found in digging for the foundations of gas-works. Two rows of parallel, horizontal oak stems, 60 to 90 centimetres thick, 3½ metres apart, were met with. They were covered with peat, and a quantity of hazel nuts and seed of cereals lay under the peat. At 3 metres deeper more hard wood was found.

PROF. A. M. MAYER asks us to make the following corrections in his article on "Floating Magnets" in NATURE for July 4 (vol. xviii.) :—On p. 258, 2nd col., line 13 from bottom, delete the sentence beginning "This is the only instance," &c. On p. 258, 2nd col., line 11 from bottom, for "This nucleus of 20 cannot be formed without the circumposed magnets as in Fig. 20," read "This nucleus can be formed without the circumposed magnets." On p. 259, 2nd col., line 11 from top, for "1*a*" read "8*a*."

THE additions to the Zoological Society's Gardens during the past week include a White-lipped Peccary (*Dicotyles labiatus*) from South America, a Golden Agouti (*Dasyprocta aguti*) from Guiana, presented by Mr. G. H. Hawtayne, C.M.Z.S.; a Bonnet Monkey (*Macacus radiatus*) from India, presented by Capt. Clarke; a Cape Bucephalus (*Bucephalus capensis*) from South Africa, eleven Spinose Lizards (*Agama colonorum*) from North-West Africa, received in exchange; a Common Marmoset (*Hapale jacchus*) from South-East Brazil, a Grey Parrot (*Psittacus erithacus*) from West Africa, deposited; a Red Deer (*Cervus elaphus*) born in the Gardens.

THE BRITISH ASSOCIATION

REPORTS.

Report of the Committee on Mathematical Tables.—Mr. James Glaisher has undertaken the calculation of the factor tables for the fourth, fifth, and sixth millions, similar to Burckhardt's and Dase's. Burckhardt's tables (Paris, 1814–1817) contain the least factor of every number not divisible by 2, 3, or 5, from unity to three millions, and Dase's tables (Hamburg, 1862–1865) give similar information for the seventh, eighth, and ninth millions. Dase undertook the calculation at the suggestion of Gauss, who urged him to begin at 6,000,000, as the three millions between 3,000,000 and 6,000,000 had been calculated by Crelle and presented to the Berlin Academy, and Gauss did not doubt that they would be published sooner or later. It appears, however, that the Berlin manuscript is too inaccurate to admit of publication, and therefore, in order to fill up the gap, it is necessary to undertake the calculation again, as the nature of the work is such that errors committed do not readily admit of discovery and correction. Mr. Glaisher has completed the portion from 3,000,000 to 4,039,500, which is ready for press, and the remaining two millions are being actively proceeded with.

Report of the Committee on Oscillation Frequencies of the Rays of the Solar Spectrum.—Mr. G. J. Stoney explained the objects of the Committee, and stated that in the table now published the oscillation frequencies of the principal rays of the visible part of the solar spectrum have been computed from Angström's determinations of their wave-lengths in air, combined with Ketteler's observations on the dispersion of air. Such a table and its accompanying map afford the most assistance that can be given towards the detection of harmonic relations, for rays that are harmonically related are therein represented in the simplest form practicable; in the table by an arithmetical series of the same type as the series of natural numbers, where the common difference is equal to the first term; and on the map by a series of equidistant lines.

Report of the Committee on Luminous Meteors.—Mr. James Glaisher read this report, which consisted of (1) an account of meteors doubly observed, with a table showing their real paths, velocities, and radiant points; (2) a detailed account of large meteors; (3) general directions and instructions to observers for recording meteors and aërolites, by Prof. A. S. Herschel; (4) the discussion of a meteor of short period (viz., the fireball of November 27, 1877, for which a short period, such as, say, 500 days, is found), by Capt. G. L. Tupman; (5) an elaborate analysis of the constituents of masses of meteoric iron and stone-falls, by Dr. W. Flight.

Report of the Committee on Underground Temperature.—Prof. J. D. Everett read this report. The principal novelty was the proposal to make observations in filled up bores by a thermo-electric method. Two wires, one of iron and the other of copper, each covered with gutta-percha, were to be joined at both ends, where a portion would be left uncovered. One junction would be buried in the bore, while the other would remain above ground available for observation. A current would flow through the circuit composed of these two wires whenever the two junctions were at unequal temperatures, and the observer would immerse the accessible junction in a basin of water containing a thermometer, and would regulate the temperature of the water until he found by a galvanometer that no current passed. He would then know that the temperature of the water as indicated by the thermometer was the same as that of the buried junction.

SECTION A.—MATHEMATICAL AND PHYSICAL.

Researches made at Dunsink on the Annual Parallax of Stars, by Prof. R. S. Ball.—The author stated that it was, of course, well known that up to the present time no parallax of a star had been detected which exceeded a single second of arc. In the great majority of cases the parallax was very much less, even if it was appreciable. But when they reflected that not one star out of ten thousand had yet been regularly examined for parallax it was obvious that it would be rash to conclude that there were no stars nearer to us than those of which the distance was already known. In selecting objects for investigation of annual parallax astronomers had generally chosen those stars which were exceptional either on account of their brilliancy or the largeness of their proper motions. Either of these features in a star afforded, doubtless, a *primâ facie* presumption that the star was comparatively near the earth. On the other hand, even Sirius had, according to Gylden, a parallax of only one-fifth of a second, while for another star, which had the enormous proper motion of seven seconds annually, Brunnow had found a parallax not greater than one-tenth of a second. The presumptions of nearness founded on great brilliancy or great proper motion, except, perhaps, in the case of 61 Cygni, could hardly be said to be justified by the results of observation. There was, however, a presumption that some of the red stars might be near the earth, and that some of the variable stars were really small, and therefore, as they were visible, comparatively near us. Before commencing the observations described and tabulated in the paper a working list was formed, containing red stars, variable stars, stars with large proper motions, and several other stars which were chosen on different grounds. The observations had the special object of seeing whether any of them had a large parallax. Forty-two different objects had been selected from this working-list, but in almost every case the observations con-

vinced him that the parallax was certainly less than one second, and most probably did not exceed half a second. It would therefore be understood that the results were purely negative so far as the immediate object in view was concerned, as they did not suggest the existence of any parallax worth following up. The principle upon which the reconnoitring observations were conducted was this:—The effect of annual parallax upon a star was to make the apparent place of the star describe a minute ellipse, of which the mean place of the star occupied the centre. The star was observed twice. At the first observation the star was at or near one of the extremities of the major axis of the ellipse; at the second observation it was at the other extremity—so that the observations were so arranged that in each case parallax would have the greatest effect it was capable of producing.

Lord Rosse gave a *Description of an Equatorial Mounting for a Three-Foot Reflector*.—The optical arrangements of the telescope recently erected at Parsonstown was exactly similar to that of previous telescopes, and it was only the mounting which was different. The wooden tube, however, which was formerly formed of staves, had been replaced by an iron tube, which was constructed after designs by Mr. Bindon Stoney. The leading peculiarities of the mounting were that the points of reversal were situated at the east and west instead of at the north and south. The bearings on which the instrument turned in right ascension were smaller than in the ordinary mountings. The motions in declination and in right ascension were effected by means of screws, so that on a windy night the instrument could not run away with the observer. The tube was square; the clock was connected with a strap, and the counterpoise was less than usual. The cage for the observer was independent of the mounting, moving on a circular rail, and with a second motion like that of a derrick crane. The only reflector of a similar size mounted equatorially was that constructed by Mr. Grubb for the Melbourne Government. Lord Rosse illustrated his explanation by means of models of his own and of the Melbourne reflector.

On the Stanhope "Demonstrator" or Logical Machine, by R. Harley, F.R.S.—Towards the close of the last century a logical instrument was constructed by Charles, third Earl of Stanhope. The present Earl found the instrument and some fragmentary papers on logic among the relics of his ancestor, and at the suggestion of Mr. Spottiswoode, placed them in the hands of Mr. Harley, who has made a careful study of them. Earl Stanhope (born 1753, died 1816) is known to science chiefly by his printing press, microscopic lens, arithmetical machine, the monochord, and steamboat. But of his logical speculations, which occupied his thoughts for thirty years, and of his curious contrivance for working logical problems, called by him the demonstrator, nothing has been known. The author did not attempt to give a complete or systematic exposition of the Earl's logical system; but he brought out those points which serve to illustrate the demonstrator as a means of performing logical inference. He noticed that Stanhope anticipated George Bentham, Sir W. Hamilton, George Boole, and others in the quantification of the predicate, and notably De Morgan's rule for the numerically definite syllogism. Stanhope states the rule as applicable to all syllogistic reasoning, and he constructed his demonstrator for the mechanical working of this rule.

On Edmunds' Electrical Phonoscope, by W. Ladd.—This is an instrument for producing figures of light from vibrations of sound. It consists essentially of three parts—an induction coil, an interrupter, and a rotary vacuum tube.

The action of the instrument is as follows:—Sounds from the voice or other sources produce vibrations on the diaphragm of the interrupter, which, being in the primary circuit of the induction coil, induce at each interruption a current in the secondary coil, similar to the action of a contact breaker, or rheotome; therefore each vibration is made visible as a flash in the vacuum tube.

The tube revolving all the time at a constant speed, the flashes produce a symmetrical figure, as the spokes of a wheel, as in the Gassiot's star.

The number of spokes or radii are according to the number of vibrations in the interrupter during a revolution of the tube, and the number of vibrations being varied to any extent according to the sounds produced, the figures in the revolving tube will be varied accordingly.

The same sounds always produce the same figures, providing the revolutions be constant. In case of rhythmical interruptions being produced in a given sound, as in a trill, most beautiful effects are noticeable, owing to the omission of certain radii in regular positions in the figure.

The uses of this instrument are the rendering visible of sounds and showing the vibrations required in their production, and is a mode of confirming by sight an appeal to the ear.

The phonoscope is the invention of Mr. Edmunds, partner in the firm of Ladd and Co., London, by whom it is manufactured.

On Byrne's Battery, by W. Ladd.—This is the invention of Dr. Byrne, of Brooklyn, U.S.A.—The chief features in this battery are a compound negative plate and a simple mechanical means for preventing polarisation.

The negative plate consists of the extreme negative element, platinum, backed up by a plate of copper to reduce the resistance, the copper being protected by a thin sheet of lead to prevent any local action that might occur owing to holes in the platinum, which might allow the exciting fluid to attack the copper, and a thicker sheet of lead on the back of the copper, which is japanned; so a plate in section would show as consisting of, first, a sheet of platinum, then thin lead, then copper, and last by the thick japanned lead, the whole being soldered together to form a solid plate. The batteries are built up with a zinc plate and two of the compound plates, the exciting fluid being a bichromate of potash and dilute sulphuric acid solution.

This battery would soon become polarised but for the injection of air between the plates, which action appears simply mechanical and not chemical, various gases producing no different effects.

When the air is pumped in the most extraordinary effects may be produced, the quantity being enormous, being more than double that of any other battery of the same size. It is much used in the States for surgical operations, its extreme portability and control rendering it peculiarly useful in this direction. The platinum loop can be raised to any temperature and kept at the same simply by the action of the foot on the bellows, leaving both hands at liberty for operating, there also being an entire absence of fumes or other disagreeable smells.

A battery of four small cells will heat nine inches of No. 16 platinum wire to redness.

There is also another form of this battery in which the platinum is platinised: the exciting solution is composed of one part sulphuric acid to ten of water. In this form no air is required to be pumped through the solution. This is used as a motor battery for driving sewing-machines. The inventor states he has driven a heavy Singer sewing-machine for eight hours a day at a cost of twopence, including everything. As yet nothing has been done in this direction in England.

Dr. Janssen gave an account of his method of solar photography, and exhibited some beautiful photographs of the sun, and Mr. G. J. Stoney explained his spectroscope of very large aperture. Mr. J. R. Wigham explained the quadriform group flashing gas light, as used at Galley Head Lighthouse, with illustrations, and also a gas gun, which might be fixed on a rock in the sea at a considerable distance from a lighthouse or a fog-signal station, and fired as often as required from the station, without the keeper leaving his post: a gas gun was placed in the college grounds, and was several times fired from the table of the room in which the section met. Prof. Haughton gave an account of his investigations on the sun heat received at the several latitudes of the earth, taking account of the absorption of heat by the atmosphere, and of his conclusions therefrom with regard to geological time.

The section was divided into two departments on the Monday and Tuesday. There were twenty-two mathematical communications which were read in the department of mathematics, including papers by Mr. Spottiswoode *On the Eighteen Coordinates of a Conic in Space*; by Prof. H. J. S. Smith, *On the Modular Curves*; by Prof. R. S. Ball, *On the Principal Screws of Inertia of a Free or Constrained Rigid Body*; by H. M. Jeffery, *On Cubic Curves*; by Mr. J. W. L. Glaisher, *On Certain Special Enumerations of Primes*, and *On Circulating Decimals*; by Mr. F. Purser, *On the Geometrical Treatment of Bi-circular Quartics*; and by Dr. Hirst *On Halphen's New Form of Chasles's Theorem on Systems of Conics satisfying Four Conditions*.

SECTION C.—Geology.

On the Influence of Strike on the Physical Features of Ireland, by Edward T. Hardman, F.C.S., Geological Survey of Ireland.—Although not often mentioned in geological works, the in-

fluence of strike in determining the lines of direction of the principal physical features of a country, is recognised by most geologists, but in few countries is the relation so distinct as in Ireland. The author was led to pay attention to this subject some years ago on reading Mr. J. F. Campbell's paper on the glaciation of Ireland,[1] in which that gentleman assumes that the south-west and north-east trend of some of the mountains of Ireland, *e.g.*, those of Donegal and Kerry, is due to the glacial action of a huge ice-sheet passing over Ireland from the south-west of Scotland. The author, after some years' examination, has found, however, that in most cases the trend of the hills, and course of rivers, &c., are determined by the strike alone, and wished to place the facts he had noted before the section.

1. *Mountains.*—The Donegal highlands trend to the south-west along the line of strike of the ancient crystalline stratified rocks. The basaltic plateau of Antrim follows in outline the windings of the outcrop of the underlying chalk, and consequently the strike of the basalt itself upheaved with it. The Mourne Mountains and Slieve Croob also coincide in direction with the stratified rocks on their flanks, except where joints or faults have given rise to minor lateral valleys, *e.g.*, Carlingford Lough. The same adherence to the line of strike is seen in the hills forming the flanks of the Wicklow Mountains; in the Kilkenny and Tipperary coal-fields; the Comeragh and Knockmealdown Mountains; and is most remarkably shown in that series of flexured carboniferous and old red sandstone rocks forming the hills of Cork and the Mountains of Kerry, the axes of which stretch from Dungarvan (co. Waterford) to Cape Clear, and Bantry Bay. The Reeks of Kerry are good examples. Its influence is again shown in the shaping of the high ground forming the Munster coal-field, and finally in the mountainous district of Connemara, although here in places obscured by the action of faults. The Twelve Pins, Muilrea, the mountains flanking Killary Harbour, and the country northwards around Nephin Mountain are striking examples. Toward the central plain the isolated mountains of old red sandstone and Silurian rocks rising through the carboniferous limestone, viz., the Slieve Bloom Mountains, the Devil's Bit, and the Galtees, conform to the same rule, the axis of strike and direction being parallel.

2. *Rivers.*—In the south of Ireland especially many of the rivers follow the windings of the strike. The Suir follows the line of strike for eighty miles, only beginning to cross it about ten miles from the sea. The Blackwater runs along the strike for seventy miles of its course, crossing it for only sixteen miles. The Lee is directed by the strike for fifty miles of its length, as is also the Bandon River for the greater part of its course, while the Shannon may be traced along the strike of the beds for by far its greatest distance.

3. *Inland Lakes.*—Most of the lakes are conformable to the strike in their greater outlines, the smaller details being determined by the jointage. Of these may be mentioned Lough Neagh, Loughs Corrib and Mask, Lough Erne—most notably—Lough Allen, Lough Derg, and the far-famed Lakes of Killarney.

4. *Sea Lochs, Bays, &c.*—The majority of these may be included—Lough Foyle, Belfast Lough, Strangford Lough, Lough Larne. The most notable examples are those on the south-west. Roaring Water Bay, Dunmanus Harbour, Bantry Bay, Kenmare River, and Dingle Bay. Also the mouth of the Shannon, Galway Bay, and Clew Bay. Farther north, the principal bays and indentations along the line of coast stretching from Broadhaven to Donegal; Killala Bay, Sligo Bay, and Donegal Bay, have been excavated in their great outlines along lines of strike.

In conclusion, the author pointed out that nature had adopted the least expensive method of working; since it is always easier to excavate along a line of strike than across the bedding. Usually cleavage, or incipient cleavage, is induced along the line of strike by the forces which upheaved the rocks, and denudation is most early effected therefore in this direction.

On the Correlation of Lines of Direction on the Globe, by Prof. O'Reilly, M.R.I.A.—The theory of correlation of the great lines of direction on the earth's surface had long been studied and applied, especially in mining; and had been generalised by Elie de Beaumont, and applied by him to the correlation of mountain chains with remarkable results, but his theory had found but little favour with English geologists. The author having been led to examine the question, based his system on angular relations actually observable in certain rocks, and in these he had found the angles 40° and 70° to bear a very important part. He gave details tending to show the relation of those angles to the main lines of direction on the surface of the globe, taking as a base line the east coast of Madagascar.

[1] *Quart. Journ. Geol. Soc.*, London, May, 1872.

On Hullite, a hitherto Undescribed Mineral from Carnmoney Hill, Co. Antrim, with Analysis, by Edward T. Hardman, F.C.S.—This mineral occurs in abundance at Carnmoney Hill, near Belfast, in the basalt forming the old neck of a miocene volcano. It has never before been described or analysed, and has been referred to on the Survey maps and in the Survey collections as obsidian, doubtless from its black colour and waxy lustre. In physical character it somewhat resembles the chlorophæite of Macculloch, but is entirely different in composition, which more resembles that of delessite. From this, however, it differs essentially in colour, hardness, and specific gravity, but it appears to belong, on the whole, to the ferruginous chlorite group.

Physical Characters.—Colour, black; hardness, about 2; lustre, waxy, but dull; before blowpipe, with difficulty fusible at edges to a black glass sometimes magnetic; very slightly affected by strong acids in the mass, but nearly entirely decomposed when boiled in powder, in strong hydrochloric acid, occurs filling and coating vesicular cavities in basalt of Carnmoney Hill, &c.

Chemical Composition.

Silica	39·43
Alumina	10·35
Peroxide of iron	20·72
Protoxide of iron	3·69
Protoxide of manganese	trace
Lime	4·48
Magnesia	7·47
Water	13·61
Carbonic acid	trace
	99·77

Formula—$(CaMgFe'')_3\ (AlFe''')_4\ Si_6O_{21} + 7H_2O$.

Specific gravity, 1·76.

SECTION D.—BIOLOGY.

Department of Zoology and Botany.

On the Stipules of Spergularia marina, by Prof. Alexander Dickson, M.D.—As is well known, certain genera of *Caryophyllaceæ*, of which *Spergularia* is one, are distinguished by the presence of stipulary appendages. On examining lately the stipules of *Spergularia marina*, I was struck with a peculiarity presented by them, which, if observed at all by descriptive botanists, has not received the attention it deserves on account of its remarkable character. The stipules are free from the petioles and wholly cellular in structure. From connation of those of opposite leaves they form interpetiolar stipules with more or less regularly, though slightly bifid, extremities. Lastly (and this is the important point), these stipules are united to each other round the backs of the petioles, so that a sheath is formed completely surrounding the axis and the two leaf-bases. This connation of stipules round the backs of the petioles is very interesting as being a rare phenomenon. Cases are not uncommon where the two stipules are connate on the inner side of the leaf-base, constituting the so-called "axillary stipule," *e.g.*, *Potamogeton lucens*, &c., or on the opposite side of the axis from the leaf, *e.g.*, *Ficus elastica*, *Ricinus*, *Astragalus alpina*, &c., constituting the "oppositifoliar" stipule; but the only reference to connation behind the leaf-base I can find is in the case of certain *Astragali*, by St. Hilaire, in his *Morphologie*. In those species of *Astragalus* which I have examined I have not seen any one in which the stipules are actually connate in this way; but in some, *e.g.*, *A. alopecuroides*, the bases of the stipules extend round the back till they meet—a condition just short of connation. In *Spergularia*, as we have seen, we have the interesting combination of the interpetiolar connation with connation round the back of the leaf. In *English Botany* I observe that the condition is fairly enough represented by the artists, but, as I have already indicated, the morphological peculiarity does not seem to have impressed itself on the botanical mind.

Dr. Bayley Balfour remarked that a good deal of confusion existed as to the application of the term stipule, and showed that in some cases it was applied to structures of very different

appearance, and perhaps even of varying morphological significance.

On the Inflorescence of Senebiera didyma, by Prof. Alexander Dickson, M.D.—When at Plymouth last August during the meeting of the British Association, I took the opportunity of examining *Senebiera didyma*, a weed which grows in great abundance on road-sides and waste places about the town, and I was much struck with a remarkable peculiarity to be observed in connection with its inflorescence.

The inflorescence is like that of the mass of cruciferous plants, racemose. The racemes are "oppositifoliar," and at first sight the arrangement seems to be analogous to that of the oppositifoliar inflorescences of *Vitis* or of *Alchemilla arvensis*, where the inflorescence is really terminal, but thrown to the side by preponderant development of a "usurping shoot," the axillary bud of the last leaf produced by the primary axis before ending in the inflorescence. This view seems further supported by the fact that of all the foliage leaves, that opposite the raceme is the only one apparently destitute of an axillary bud, which on the supposition would be represented by the "usurping shoot." If, however, the plant is more closely examined, a very remarkable condition is disclosed, one, indeed, which offers a morphological problem of considerable difficulty, and which, probably, can be effectually solved only by developmental study. The peculiarity consists in the constant occurrence of a solitary flower springing somewhere from the internode below the raceme either about half way down towards, or almost close to the level of the leaf below. So far as my observations go, the solitary flower is never quite as low as the level of the lower leaf. It might be supposed that from almost immediately above the second last leaf of the main axis, the bases of the terminal raceme of the "usurping shoot," and of the axillant leaf of that shoot had all become fused together. Now, although cases are known on the one hand, of adhesion between the base of a terminal flower and that of the usurping axis (*e.g.*, *Helianthemum vulgare*, Payer), and, on the other hand, between the base of an axillant leaf and that of the usurping shoot in its axil (*e.g. Sedum*, sp. Payer), we do not know of connation of all three together. It is possible, but I think improbable.

The view which, after careful consideration, occurs to me as most fully satisfying the conditions of this remarkable case, may be stated briefly in categorical form as follows:—

1. The racemose inflorescence is terminal and properly begins just above the level of the "second last" leaf. It would thus include the aforesaid solitary flower.

2. The raceme, after producing one ebracteate flower, produces at its second node a foliage leaf from whose axil the "usurping shoot" springs.

By such an explanation we can dispense with any cumbrous adhesion hypothesis such as I have indicated above. The peculiarity is that the main axis does not, *per saltum*, pass from the condition of a leafy axis to that of an axis of inflorescence, but begins by producing one flower and then developing a foliage leaf beyond which the series of flowers is uninterrupted. The "usurping shoot," as above indicated, represents the axillary bud of the foliage leaf by which the raceme is interrupted.

On the 6-celled Glands of Cephalotus and their Similarity to the Glands of Sarracenia purpurea, by Prof. Dickson.—Dr. Dickson pointed out that the peculiar 6-celled glands found on the external surface of the pitcher, both surfaces of the pitcher-lid, and both surfaces of the foliage-leaf of *Cephalotus* are very nearly identical in structure with the glands on both inner and outer surfaces of the pitcher of *Sarracenia purpurea*, which were originally described by August Vogl. Dr. Dickson suggested that the remarkable resemblance in this respect, taken in connection with certain correspondence in the details of the insect-trapping apparatus might suggest an affinity not hitherto suspected.

Exhibition of Plants of Isoetes echinospora.—Dr. Dickson exhibited specimens referable to this species which he lately found growing on muddy bottom among Potamogeton in about two feet of water in Loch Callater, Aberdeenshire. The plants were remarkable for the very slender and tapering character of the leaves which curve outwardly. The spores are very markedly echinate, and in diameter about one-fourth smaller than those of *I. lacustris*.

Dr. Moore, Glasnevin, exhibited remarkable specimens of an Isoetes from Lough Bray, co. Wicklow. They were of great size, much above the average of specimens of *I. lacustris*. Prof. Suringar and Prof. M'Nab suggested that it might be the same as the Italian species known as *Isoetes malinverniana*.

Mr. Britten exhibited, on behalf of Mr. J. H. A. Jenner, specimens of *Rumex maximus*, Schreb, from a new locality on the Cuckmere River, East Sussex. The specimen sent showed the various characters by which *R. maximus* can be distinguished from *R. hydrolapathum*, the species with which it has been confounded.

Dr. Bayley Balfour exhibited, on behalf of Mr. Sadler, specimens of *Salix Sadleri* and *Carex frigida* obtained at the beginning of August in Corrie Chandler, Aberdeenshire. These plants were discovered in 1874 by Mr. Sadler, and have not been met with again until this year.

Notes on Naiadaceæ, by Dr. Bayley Balfour.—Dr. Balfour more particularly described some of the peculiarities observed by him in the genus Halophila, an extremely interesting tropical phanerogamous plant.

Dr. Price, of Chester, sent for exhibition portions of the leaves of *Cardamine pratensis* producing numerous gemmæ.

On the Supposed Radiolarians and Diatomaceæ of the Coal-Measures, by Prof. W. C. Williamson, F.R.S.—Prof. W. C. Williamson called attention to the *Traquariæ* of Mr. Carruthers, found in the lower coal-measures of Lancashire and Yorkshire, with small spherical objects that observer believes to be radiolarians like those still living in existing seas. Prof. Williamson showed that the radiating projections with which these spheres are surrounded were not siliceous spines like those of the Radiolariæ, but extensions of a continuous membrane which enclosed the entire organism, and which therefore could not have the spicular nature attributed to them. He then demonstrated that within this external membrane is a second inner one, which latter is filled with numerous small vegetable cells, like others shown to exist in the interior of fossil spores and reproductive cryptogamous capsules, found in the same beds as those which furnish the *Traquariæ*.

These conditions are so different from those existing in any known recent species of radiolarian as to lead Prof. Williamson to reject the idea of their radiolarian character; whilst their close organic resemblance to some obviously vegetable conceptacles found in the same coal-measures suggest that the *Traquariæ* are also vegetable structures.

The mountain limestone deposits of some British localities contain a vast multitude of minute calcareous organisms which Mr. Sollas and other observers have regarded as radiolarians. These structures, however, seem to exhibit no satisfactory evidence of being so. In the first place these organisms are now calcareous instead of siliceous. It has been suggested that their siliceous elements were removed, and replaced by carbonate of lime, but this appears to be most improbable.

Prof. Roscoe and Prof. Schorlemmer agree in stating that they would require overwhelming evidence before they would be prepared to accept such an explanation of the present condition of these objects or of the fact of the substitution of carbonate of lime for silica, that such an explanation renders necessary.

Count Castracane has published an account of a process by which he reduced numerous specimens of coals to very minute quantities of coal-ash, and has stated that he found in these ashes numerous marine and fresh-water diatomaceæ. Prof. Roscoe kindly allowed one of his ablest assistants in his laboratory at Owens College to prepare analyses of a number of coals according to Count Castracane's method. The residual ashes of these preparations have been mounted microscopically by Prof. Williamson, and in no one of them can a trace of a diatom be found. Beyond stating the fact he is wholly unable to account for the discrepancy between his results and those of the Italian observer, so far as his present observations go, he finds himself compelled to conclude that we have no proof of the existence of radiolarians or of diatomaceæ in the British carboniferous rocks.

A short discussion ensued, in which Sir Joseph Hooker, Prof. M'Nab, and Dr. Bayley Balfour took part, the views expressed coinciding generally with those of Prof. Williamson.

On the Association of an Inconspicuous Corolla with Proterogynous Dichogamy in Insect-fertilised Flowers, by Alex. S. Wilson, M.A., B.Sc.—The majority of conspicuously-coloured flowers whose cross-fertilisation depends on their being easily seen by insects, are proterandrous. Such plants have their flowers placed in close inflorescences, as, for example, in Erica, Calluna, Vaccinium, Digitalis, Linaria, Gladiolus, &c., and occasionally the flowers are secund, or placed on one side of

the axis, thus becoming more conspicuous. In the indefinite mode of inflorescence the older flowers are placed at the lower part of the flowering axis; hence in the commonest form of inflorescence with proterandrous flowers, the lower flowers are in the second or female stage at the time when those in the upper part are in the first or male stage. In proterogynous dichogamy with indefinite inflorescence, the older flowers are in the second or male stage when the upper and younger flowers are in the female stage. In *Scrophularia nodosa* we have a plant in which proterogynous dichogamy is associated with an *inconspicuous* corolla. The stigma after fertilisation is removed out of the pathway to the nectar by the bending back of the style on the outside of the corolla, while the stamens straighten out to occupy the place formerly held by the stigma. The corolla is small and obscurely coloured, being greenish, tipped with brown. The inflorescence is lax, and the flowers scattered all round the axis. The odour of the flowers and the presence of a nectariferous gland shows that the plant is fertilised by insects, and not by the wind. Among such inconspicuously-coloured flowers, proterogynous dichogamy seems to prevail, just as proterandry is characteristic of brightly-coloured flowers. Hitherto it has not been shown how an entomophilous plant could advantageously possess a small uncoloured corolla, and be proterogynous. Watching the mode in which wasps visited the *Scrophularia nodosa* afforded the solution of the problem. The first flower visited by the wasp was the top one, and it passed irregularly downwards from flower to flower, and left the inflorescence by the lowest flower. Bees, when collecting honey, do the reverse, visiting the lowest flower first, and proceeding from flower to flower in regular succession from below upwards, leaving by the top flower. The order in which the flowers are visited is therefore of the greatest importance. In Gladiolus, for example, the bee begins at the lowest flower, and will deposit any pollen brought by it from a neighbouring spike, and as it passes upwards, it will get from the *upper flowers*, a fresh supply of pollen to apply to the lower flowers of another spike. In *Scrophularia nodosa* the wasps, which are less highly specialised as honey collectors, chiefly visit the flowers and proceed from above downwards, leaving the inflorescence with pollen from the lower flowers to apply it to the stigmas of the proterogynous upper flowers.

Wasps differ from bees in one important point, viz., that while bees are purely vegetable feeders, wasps add to a vegetable diet by preying largely on insects smaller than themselves. Throughout the animal kingdom carnivora are endowed with keener powers of vision and scent than vegetable-feeding creatures. That keenness of vision which enables a wasp to descry its prey at a distance, aided by its acute sense of smell, in all probability also enables it to discover these obscure flowers, without the guidance afforded by a coloured corolla, the materials that would be required for its production being employed more economically by the plant, just as in cleistogamic flowers. The wasp also gains an advantage, as it has a better chance of finding honey in these obscure flowers on account of their being easily overlooked by insects less highly endowed as regards powers of scent and vision.

Notes on Dimorphic Plants, by A. S. Wilson, M.A., B.Sc.—The author pointed out that *Erythræa centaurium* was probably dimorphic, as it exhibited heterostyly, and had two kinds of pollen-grains. *Silene acaulis* was shown to have three kinds of flowers, male, female, and hermaphrodite, thus resembling *S. inflata*, which Axel has shown to be tricœciously polygamous.

Some Mechanical Arrangements Subserving Cross-fertilisation of Plants by Insects, by A. S. Wilson, M.A., B.Sc.—The plants considered were *Vinca minor*, *Pinguicula vulgaris*, and the foxglove, and the author described the various structural peculiarities in the different flowers.

THE FRENCH ASSOCIATION

AS might have been expected, M. Krantz has been appointed president for the Congress of 1880; but, contrary to all expectation, the decision of the Council who had proposed Algiers as the place of the meeting for 1880 has been altered, and Rheims has been chosen by a large majority. This unexpected vote will create some dissatisfaction in the colony, where great expectations had been raised by the coincidence of the anticipated arrival of the Association and the celebration of the fiftieth anniversary of the conquest.

Dr. Janssen delivered, in the large room of the Sorbonne, a lecture on the present state of physical astronomy, which was completely successful; but it was deeply regretted that no direct news had come of the eclipse and the discovery of Vulcan.

A great *soirée* was given in the Conservatoire des Arts et Métiers, and M. Cornu delivered, in the large hall, an able lecture on Polarisation. The most important part of the display was a series of twenty Jablockhoff lights, exhibited in the gardens. The effect, although splendid, cannot be said to have been better than in the Avenue de l'Opéra and round the Arc de Triomphe.

A banquet of 200 covers was given on Thursday, at the Continental Hotel, to M. Bardoux, the future president of the Montpellier meeting, and present Minister of Public Instruction. On the following evening a great reception was held at the Ministry of Public Instruction, M. Bardoux having opened his *salons*, not only to the members of the Association, but also to the delegates of public schools now visiting the Exhibition at the public expense.

The Paris meeting, however, has been comparatively lost amongst the many special congresses which are taking place without interruption in the Trocadéro, and of which none attracts much public notice. Meteorology had its special congress, holding its sitting at the very same hour when the meteorological section of the French Association was deliberating. Although a large number of influential meteorologists had congregated, none of them could find the means of attending regularly both meetings.

No paper of real importance has been read in any of the sections.

In provincial cities the coming of the Association is always coupled with the inauguration of some public monument, library, museum, schools, &c. No similar ceremony took place in Paris, so that in that respect, as in many others, this thriving Association may be said to have lost a year.

M. Frémy, in his presidential address on soda and steel, traced the history of the improvements in the manufacture of these productions during the past century, showing that at every important stage science stepped in and pointed out the direction which practice ought to take in order to secure progress and success. Science was always at her post, ready to solve, to the advantage of industry, all the problems proposed to her. In showing the important services that science has thus rendered to industry and to the country, he wished to prove that in supporting men of science, by encouraging scientific production, we give to the country natural forces and accomplish a patriotic act. Blind and egoistic spirits have dared to say that science has no need of encouragement, that the true man of science forms himself all alone, that he knows how to triumph over obstacles, that the difficulties which he meets with are necessary trials which only arrest mediocrity, and that he who stops by the way, wanting the scientific inspiration, deserves his fate. Such affirmations are only maintained by those who have not known the difficulties of the scientific career, and who often owe their advancement to favour. We could, alas! cite many examples which prove that the most ardent and courageous man of science may be arrested in his labours by invincible obstacles. M. Frémy then referred in warm terms to the many generous individuals who in France have come to the aid of scientific research, and at the same time said it would be unjust not to recognise all the efforts which have been made in recent years by the state to maintain in France the higher scientific studies. Magnificent and well-endowed laboratories, new scientific chairs, the school of higher studies—these are some of the services rendered by the French government to science. But it is necessary to attract to these laboratories men who are capable of making good use of them, men who really possess the vocation for scientific research, and to prepare a scientific generation to succeed the present. M. Frémy then showed that the French Association might help greatly in promoting this service to science.

PROF. HAECKEL ON THE DOCTRINE OF EVOLUTION

ON Thursday, August 28, a banquet was given to Prof. Haeckel, at the Grand Hotel, Paris, by a number of his admirers, on the occasion of his presence at the Paris meeting of the French Association. A congratulatory address was delivered in the name of the Reception Committee by M. Jules Soury, one of the Staff of the National Library, who said

that men of science were witnessing a secular movement of renovation in France as well as in Germany. Prof. Haeckel then gave an address, containing one of the most uncompromising statements of what he believes to be the logical consequences of his doctrine that has been given by any living evolutionist. We translate from the *Revue Scientifique*.

"The friendly support which I have received in your midst touches me more than I shall say, for it is not only the man and the works which he has been able to produce that you have wished to honour; our profound love of scientific truth, our philosophical beliefs, our faith in the theory of evolution and in that doctrine of descent for which I venture to say I have already fought well, this, gentlemen, is the secret of the sympathy which unites us to-day. I have seen with great joy in the meetings of the scientific congress how the theory of evolution has already, whatever may be said, penetrated the spirit of French *savants*. In the sections of Biology the theory of transformism has appeared to many speakers the only explanation of the phenomena of life which they have studied. The last consequence of that doctrine—the descent of man, not only from the apes, but from all the series of lower organic forms, has even been proclaimed and vigorously defended by M. de Mortillet in the Anthropological Section."

"Prof. Haeckel then proceeded to state the doctrine of the descent of man, so well known in connection with his name. "Certainly," he said, "man does not descend directly from any existing anthropoids. No serious naturalist has professed that doctrine, which has currency only among the general public and theologians. For a long time frivolous and ignorant people have found a subject of pleasant and innocent gaiety in the thought that we wish to pass them off as improved apes. No one dreams of this; but certain professors of philosophy, and a number of facetious preachers, nourish this prejudice, which brings them fine and easy successes. They do not seem to have any idea that they furnish the best argument in favour of that theory, if it is sustainable. Are not their *naïve* pride, their infantine vanity, weaknesses of character which the apes have left us as a legacy? There can be no doubt that man and the apes of the Old and New World are descended from a common ancestor.

"That which, sooner or later, will lead all good minds to transformist doctrines is the feeling, every day more profound among us, of universal causality, of development, of continuity in nature. The number increases every day of those who seek the truth, the whole truth, and who rest only in the clear vision of the universal connection of effects and causes.

"Reason, causality, mechanism, on one side; superstition, mysticism, teleology, on the other. The theory of evolution, which considers and embraces entire nature as one whole, has replaced final causes by efficient causes. This has already been accepted, at least by philosophical minds, the only ones of which we need take count, for the old doctrines of the final causes of the unwise, the immutability of species, sterility of hybrids, geological catastrophes and successive creations, the impossibility of spontaneous generation, and of the youth of man on the earth.

"We cannot say at what moment of time nor under what conditions the first living beings appeared at the bottom of the sea, but there can be no doubt that they have been formed chemically from inorganic carbon compounds. The primitive monads were born by spontaneous generation in the sea, as saline crystals are born of their mother-waters. There does not exist, in fact, any other alternative to explain the origin of life. He who does not believe in spontaneous generation, or rather in the secular evolution of inorganic matter, into organic matter, admits miracle. It is a necessary hypothesis, which cannot be ruined either by *à priori* arguments or by laboratory experiments.

"The time has arrived to replace the antique dualistic and theological conception of life and spirit by the monistic or mechanical conception of the universe. We have arrived at the boundaries of the old and new faith. Mystery exists, perhaps impenetrable; in any case, scholastic arguments will not pierce it. The doctrine of final causes has all the *naïveté* of the explanations which prevail among savages and children; the theories of Lamarck and Darwin have given the last stroke to that decrepit doctrine. Modern morphology is irreconcilable, not only, I say, with the dogma of creation, but with that of a Providence or of a vague idealistic Pantheism, of the kind associated with the names of Hegel, Schopenhauer, and Hartmann. If there certainly exists in reality, as I have striven to show, an etiological connection between individual development and the development of ancestry, between ontogenesis and phylogenesis, the phenomena of human embryology are only *mechanical* and necessary effects of the evolution of our remote ancestors, conformably to the laws of heredity and adaptation.

"Seventy years ago, permit me to remind you, the great Lamarck created the theory of descent, which Darwin, half a century after, was to develop by fecundating it with his doctrine of selection, founded on the physiological properties of heredity and adaptation. Goethe had also conceived that doctrine very philosophically. For it is the honour of our conception of things to have seduced philosophers, poets, and critics, such as Kant, Goethe, and Strauss.

"These great and noble geniuses saw imperfectly, gentlemen, that which we see better to-day; I mean to say that the theory of evolution is only a particular case of the most vast of cosmical hypotheses, that of the transformation and conservation of the physical forces. This is what the best minds, the most judicious and wisest, such as the eminent naturalist of Montpellier, of whom France ought to be proud, Prof. Charles Martins, now admit with entire good faith. According to Prof. Martins, in fact, "the theory of evolution binds together all questions of natural history, as the laws of Newton have bound together the movements of the celestial bodies. *That theory has all the characteristics of the Newtonian laws.*"

"Certainly, the laws of life, morphological laws, the laws of transformation of living beings, under the influence of adaptation and heredity, of selection and vital concurrence, are not susceptible of the mathematical rigour of the laws of astronomy. We cannot, however, doubt that they exist, as we do those of psychology, ethology or science of character, and social science. It is, I think, somewhat *naïve* to insist, as is often done, on the numerous anomalies which are observed among living human beings. These anomalies are only apparent as are perturbations in astronomy. If we possessed all the elements of these morphological laws, the solution, at least in part, of which I have at heart, we should see that these apparent anomalies are explained by the general laws of mechanics. No one denies that the extreme instability of the elements constituting the woof of organised beings renders biological problems of an infinite complexity.

"Our mission—to which we have succeeded after the great heroic generation of *savants* of the eighteenth century—for they were heroes, gentlemen, and the greatest of all perhaps, the Laplaces, Lavoisiers, Kants, Lamarcks, Frederick Wolffs—our mission to all, naturalists, physiologists, physicians, philosophers, linguists, historians, is to continue those traditions of powerful thought and manly love of liberty which made our grandfathers almost the equals of those Greeks of Ionia and Attica whom we venerated in our infancy as the fathers of all human science."

PROF. NORDENSKJÖLD ON THE COMPOSITION AND COMMON ORIGIN OF CERTAIN METEORITES[1]

PROF. NORDENSKJÖLD on comparing the composition of the meteorites which fell at Ställdalen in Sweden on June 28, 1876 (NATURE, vol. xvi. p. 238), with that of a number of other meteorites, has found that a remarkable similarity, if not identity, is disclosed by excluding the larger or smaller quantities of oxygen and sulphur which enter into their composition, and taking into consideration only the metallic constituents, irrespectively of their being oxidised or not. This similarity in composition is found to exist between various meteors, which, according to the common method of giving the results of analyses of meteorites, that is, by stating separately the metallic iron, sulphide of iron, soluble and insoluble silicates, &c., appear to be of quite dissimilar nature and composition. The meteorites compared are :—

I. Erxleben, 1812, April 15, analysed by Stromeyer.
II. Lixna, 1820, July 12, analysed by A. Kuhlberg.
III. Blansko, 1833, November 25, analysed by Berzelius.
IV. Ohaba, 1857, October 15, analysed by Bukeisen.
V. Pillistfer, 1863, August 8, analysed by Grewingk and Schmidt.
VI. Dundrum, 1865, August 12, analysed by Haughton.
VII. Hessle, 1869, January 1. *a*, analysed by G. Lindström,

[1] Abstract of paper in *Trans.* Geol. Union of Stockholm, 1878, No. 44.

pieces of a large stone; *b*, average of two analyses by Nordenskjöld of whole stones, weighing 1,063 and 0·64 grm.

VIII. Orvinio, 1872, August 31, analysed by L. Sipöez. *a*, chrondritic ground-mass; *b*, black connecting mass.

IX. Ställdalen, 1876, June 28, grey ground mass, analysed by G. Lindström.

Composition of Meteorites, excluding the Oxygen, Sulphur, Phosphorus, and Chlorine found in them.

	Si.	Mg.	Fe.	Ni.	Co.	Mn.	Ca.	Al.	Na.	K.	Cr.	Sn.
I.	26·11	21·79	44·29	2·43	—	0·83	2·13	1·31	0·85	—	0·26	—
II.	26·70	23·61	42·90	2·68	—	0·66	trace	2·12	0·83	trace	0·50	—
III.	26·91	23·22	43·12	1·59	0·09	0·56	1·02	1·85	0·85	0·25	0·42	0·12
IV.	26·12	21·52	47·82	2·75	—	0·18	—	0·23	1·12[1]	—	0·26	—
V.	28·02	22·09	42·99	2·92	—	0·01	0·53	2·07	0·39	0·31	0·53	0·14
VI.	27·55	20·45	44·74	1·58	—	0·44	2·09	0·70	0·72	0·66	1·07	—
VII. *a*.	26·26	21·28	43·57	3·29	0·03	0·50	1·97	1·94	1·05	—	0·08	0·03
b.	26·43	23·07	41·37	3·30	trace	trace	2·28	1·27	1·78	—	0·49	0·01
VIII. *a*.	26·09	21·28	43·29	3·16	—	—	2·46	1·75	1·59	0·38	—	—
b.	26·65	20·18	42·55	4·71	—	—	2·56	1·91	1·10	0·34	—	—
IX.	25·66	21·41	44·83	2·73	0·26	0·29	1·77	1·74	0·71	0·18	0·42	—

Every one who has had experience of the analytical examination of meteorites, which is often very difficult, or at least tedious, writes Prof. Nordenskjöld, and who knows the difficulty of obtaining any proper average sample on account of the preciousness of the material, will perhaps see that here the question is no longer concerning an accidental similarity in the figures obtained, but an actual identity, showing that all those meteorites which have fallen in the course of more than fifty years form a natural group having a common origin. I have not yet been able to treat in the same way all the accessible analyses which, when those that are quite trustworthy are only in question, are less numerous than is commonly supposed. I consider it certain that it will be possible to arrange several other similar natural groups, and that very many other meteorites than those here enumerated belong to this group, which perhaps may be called Hessleites after the most abundant, most completely examined and analysed meteor fall.

It appears to me highly probable that all Hessleites belonged either in a completely metallic or in a *fully* oxidised condition to the same swarm of meteors revolving in our solar system, and that the differences in composition now exhibited by the meteorites belonging to the same group depend on changes to which the meteorites were afterwards subjected by being heated under the influence of oxidising or reducing substances.

With respect to the group now in question it is clear, from the microscopic structure of these meteorites, that the metallic iron forms their most recent constituent, and that it has thus arisen through reduction of the ferriferous silicates.

Where has this reduction proceeded? Probably not in the atmosphere of our globe, though the carboniferous substances which occur in a great number of fire-balls may very well form the necessary reduction material; possibly on the exploded heavenly body, of which these meteorites, according to a sufficiently hazardous and probably incorrect hypothesis, may form fragments; most probably, perhaps, in passing the perihelion, during the revolution of the meteor swarm round the sun.

That, besides, both reducing and oxidising influences, if on a smaller scale, make themselves felt during the short path of the meteors in our atmosphere, is shown on the one hand by the shining iron particles which are often found on the surface of the meteorites, and on the other hand by a comparison of the analyses of the large and small meteorites from Hessle; for while the large contain a considerable quantity of sulphur (1·88 per cent.), the small are nearly free of it (containing only 0·18 per cent.), clearly for the reason that the sulphur in them has been oxidised and driven off.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

FROM the Twenty-fifth Report of the Science and Art Department, we learn that the number of schools examined in 1877 was 1,348, the number of pupils under instruction being 55,927. These numbers are smaller than in 1876. This decrease was entirely due to the withdrawal of physical geography from the list of subjects for which aid is given; for in the remaining subjects a substantial increase had taken place. The subject added to the list when physical geography was withdrawn, viz., physiography, has already secured a large amount of attention; and it is probable that no less than 5,000 candidates will present themselves for examination in it in May next. The above-mentioned 1,348 schools comprised 4,635 different classes, from which 32,112 students came up for examination in May, in addition to 3,230 self-taught students and pupils in classes not taught by certificated teachers. From the results of the examination it is seen that the number of papers passed compares favourably with the statistics of previous years. The number of candidates who came up in honours was 1,029, of whom 85 passed in the first class and 192 in the second class. From the reports on the general character of the examinations which have been received from the examiners, it appears that the results of the examinations are generally of an encouraging nature. Some of these reports contain very valuable suggestions as to methods of teaching, &c., and they have been printed and circulated among the schools. The number of competitors for Whitworth Scholarships in 1877 was sixty-eight. Of these nineteen of the most successful in the theoretical subjects of competition were admitted to go forward to the examination in practical workmanship, which was as in previous years, held at the workshops of Sir J. Whitworth and Co., in Manchester. The Committee of Council state that they have received from the Council of the Royal Society a report of the work done by the gentlemen to whom grants had been made during the year 1877–78 out of the vote of 4,000*l.* for research. This vote was first made in the year 1876–77, the correspondence with reference to it being given in our last, the Twenty-fourth Report, at p. 7 of the Appendix. But owing to the period of the year at which the vote was finally sanctioned, the recommendation of the Council of the Royal Society was not received till March 16, 1877, and only 2,195*l.* 1*s.* 6*d.* came into payment out of that vote, the remainder being returned to the Exchequer. Considering the nature of these inquiries and the time necessarily devoted to preliminary experiments, it was not to be supposed that there would be much definite result to show in the first year. But on the whole very satisfactory progress has been made, and much good work already accomplished, several valuable papers having been contributed to the Royal Society.

WE would draw the attention of teachers in London and its neighbourhood to the admirably organised teachers' classes at St. Thomas Charterhouse School of Science. The session commences on the 28th inst., and those wishing for information should apply to the organising secretary, Mr. C. Smith, at St. Thomas Charterhouse Schools, Goswell Road.

AT a recent meeting of the council of the Yorkshire College, the following appointments were made:—As Lecturer in German and Oriental Languages, Joseph Strauss, Ph.D.; as Lecturer in French, John Willis, Ph.D. Both the new lecturers will commence their duties with the coming session, in October.

WE have received a very elaborate programme of the mathematical courses for the session 1878–9, under Prof. Sylvester, at Johns Hopkins University, Baltimore. Other circulars give a similar announcement in respect to the courses to be followed in languages, chemistry, physics, and biology.

THE University of Helsingfors will celebrate the fiftieth year of its existence during this autumn. The Finlandic University was originally at Abo, and was transferred to Helsingfors in 1828.

THE University of Zürich has just bestowed the title of Doctor of Jurisprudence on a young Russian lady, who obtained the highest honours in her examination for this degree.

AN institution for the higher education of ladies will shortly be opened at Kieff.

SOCIETIES AND ACADEMIES

LONDON

Entomological Society, August 7.—H. W. Bates, F.L.S., F.Z.S., president, in the chair.—A communication was read from Mr. M'Lachlan to the effect that, in the writer's opinion, the larva referred to by Prof. Westwood at the last meeting of the society, as boring in the stems of the potato, was in all probability that of a *Noctua-Gortyna flavago*, polyphagous in the stems of a variety of herbaceous plants.—Mr. S. Stevens exhibited some living specimens of *Teretrius picipes*, parasitic on

[1] And potash.

Lyctus oblongus, and also specimens of *Pachnobia alpina*, bred from pupæ found on the highest parts of mountains about Rannoch, N.B.—Mr. Enoch exhibited some remarkable varieties of British lepidoptera.—Mr. Rutherford exhibited some living specimens of an ichneumon (identified by Mr. F. Smith as *Cryphus formosus*), parasitical on the larvæ of a West African moth, allied to *Anapha panda*.—Mr. Rutherford also exhibited a series of colour varieties of the African butterfly, *Aterica meleagris*, as illustrative of the principles of protective assimilation and of some remarks he contributed thereon.—Mr. Jenner Weir exhibited five remarkable specimens of *Argynnis paphia*, and contributed some remarks on melanic variation in that species.—Mr. Wood Mason read a paper on the difference between the form of the antennæ in the males of *Idolomorpha* and other genera of *Empusidæ*, a sub-family of Mantidæ.—Mr. Dunning read a paper on the genus *Acentropus*.—The following papers were also communicated:—Descriptions of several new species of myriopoda of the genera *Sphærotherium* and *Zephronia*, by Mr. Butler; and descriptions of new genera and species of South American *Eumolpidæ*, chiefly from the Amazon region, by Mr. Baly.

GENEVA

Physical and Natural History Society, February 21.—Prof. Marignac having transformed into nitrates the gadolinite earths for the purpose of decomposing them afterwards by heat, obtained, after many successive experiments, products more and more pure, showing the existence of a third earth—terbene. The yellow tint of its oxide does not result from the presence of didymium in this oxide.—Prof. Soret described the principal results of his researches on the ultra-violet absorption spectra. Most of these spectra are continuous up to a given line, from which the radiations are more and more obstructed. The bases and the acids generally carry their absorbent properties into the salts which they compose.

March 21.—Prof. Alph. de Candolle read a memoir on the appearance and the falling of leaves of trees. He was not able to discover any direct and regular connection between the periods of the two phenomena. Among the species seen, individuals present great differences in this respect; we find sometimes that individuals earliest to get their leaves in spring are latest in autumn to lose them, but the exceptions to this rule are numerous. One specimen presenting singularities in this respect preserves, in general, its qualities from year to year (see *Arch. des Sc.*, t. lxii. p. 143).—Prof. Brun spoke of the causes of the movement and of the different modes of reproduction of diatomaceous algæ, which multiply by subdivision and by spores, and which live in the most diversely situated localities in the Sahara, as at altitudes of 2,600 metres in the Alps.

April 4.—Prof. F. A. Forel has studied the sculptured pebbles on the strands of the Lake of Geneva. Some are incised by a larva of the species *Hydropsyche*, others are covered with a tufoid incrustation, underneath which the calcareous stones are deeply sculptured. The incrustation results from the action of two algæ, *Enactis calcivora* and *Hydrocoleum calcilegum*.—M. Victor Fatio presented the report printed by him on the International Congress on Phylloxera at Lausanne, entitled "State of the Phylloxera Question in Europe in 1877."

April 18.—M. Alph. Favre read a note on the mode of formation of some stratified mountains and some valleys, which he explained by the ramming or lateral crushing of the geological strata. He has made experiments tending to prove his theory, by means of caoutchouc stretched out and covered with potter's clay, left to contract gradually. (*Arch. des Sc.*, t. lxii. p. 193.)—Prof. Soret, by means of the observation of the ultra-violet absorption spectra of gadolinite earths, has confirmed the conclusions of M. Marignac and M. Delafontaine on the existence of terbene and of another yellow earth besides terbene and yttria.—M. Arthur Achard indicated a peculiarity in the action exercised by a magnetic pole in a circular closed current. If we imagine the pole approaching nearer and nearer the plane of circumference by projecting beyond the latter, there will be an angular situation for which the component perpendicular to the plane of the current, from the action exercised by the pole on the latter, changes its sign. It follows that two opposite poles, the one on this side, the other on that of the situation thus defined, will exercise on one and the same circular current concordant actions.

PARIS

Academy of Sciences, August 26.—M. Fizeau in the chair.—The following, among other papers, were read:—Employment of the right ascension of the moon, corrected from tabular errors, for determining longitude at sea, by M. Faye. He indicates some modifications by which the errors in Hansen's tables may be corrected.—Comparison between the salivary and the sudoriparous glands, relatively to the way in which they are affected by section of their excito-secretory nerves, by M. Vulpian. Jaborandi still acts on the sub-maxillary gland several days after section of the excito-salivary nerves, whereas this plant, or its alkaloid, pilocarpine, from the sixth day after section of the sciatic nerve (which seems to contain all the excito-sudoral fibres of the posterior limb), has no longer action on the sudoriparous glands of the corresponding limb. M. Vulpian thinks the probable reason for the dissimilarity lies in the enormous quantities of nerve-cells, isolated, or in ganglionic groups, distributed throughout the secretory nerves which go to the sub-maxillary gland. These, after section of the nerves, probably prevent the fibres gradually losing their excitability as far as their peripheric extremities.—On the vibratory forms of solid and liquid bodies (third memoir), by M. Decharme. He finds that on circular plates (thrown into vibration) the breadths of the striæ are inversely proportional to the square roots of the numbers of vibrations of the corresponding sounds.—On pelletierine, an alkali from the bark of the pomegranate, by M. Tanret. Its mode of preparation and its properties are described; also the proportions got from the bark of different parts (most is got from the dry roots). Pelletierine is the tænicide principle of the pomegranate, not previously isolated.—Researches on strychnine, by MM. Gal and Etard. By causing hydrated baryta to act on strychnine under certain conditions, two new bases were obtained: they are called respectively, *dihydrostrychnine* and *trihydrostrychnine*.—Researches on the relations existing between the weights of the bones of the skeleton of a buffalo, by M. de Luca. The entire skeleton weighs about 29 kilogs. The lower jaw weighs a fifth of the cranium; the head (without lower jaw) as much as the vertebral column; the pelvis four times the sacrum; the bones of the head a fourth of the skeleton, the cervical vertebræ, the dorsal, and the lumbar, with sacrum and caudal vertebræ, about equal; the bones of the two anterior limbs double the posterior; the bones of the right side weigh more than the corresponding bones of the left. Of the vertebræ the atlas weighs most; the weight then diminishes on to the last dorsal, then increases and is stationary in the lumbar vertebræ; in the caudal the weight diminishes progressively, &c.

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